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U.S. Fish and Wildlife Service Department of the Interior

ENVIRONMENTAL ASSESSMENT FOR IMPLEMENTATION OF COMPREHENSIVE CONSERVATION PLAN FOR SQUAW CREEK NATIONAL WILDLIFE REFUGE

Abstract: The U.S. Fish and Wildlife Service is proposing to implement a Comprehensive Conservation Plan (CCP) for the Squaw Creek National Wildlife Refuge in Missouri. This Environmental Assessment (EA) considers the biological, environmental, and socioeconomic effects that implementing the CCP (the preferred alternative is the proposed action) and four other alternatives would have on the issues and concerns identified during the planning process. The purpose of the proposed action is to establish the management direction for the Refuges for the next 15 years. This management action will be achieved by implementing a detailed set of goals, objectives, and strategies described in a CCP.

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Chapter 1: Purpose and Need for the Proposed Action

1.1 Purpose And Need For Action

1.1.1 Purpose

The U.S. Fish and Wildlife Service is proposing to prepare and implement a Comprehensive Conservation Plan (CCP) for Squaw Creek National Wildlife Refuge (Refuge). The Refuge is located in northwestern Missouri near Mound City and approximately 70 miles north of Kansas City, Missouri (Figure 1).

The purpose of the proposed action is to establish the management direction of the Refuge for the next 15 years. The action is needed because adequate, long-term management direction does not exist for the Refuge. Management is now guided by several general policies and short-term plans. Future management direction will be defined in a detailed set of goals, objectives, and strategies described in the CCP. Another purpose is to adopt the Fire Management Plan for the Refuge and make it available to the public again.

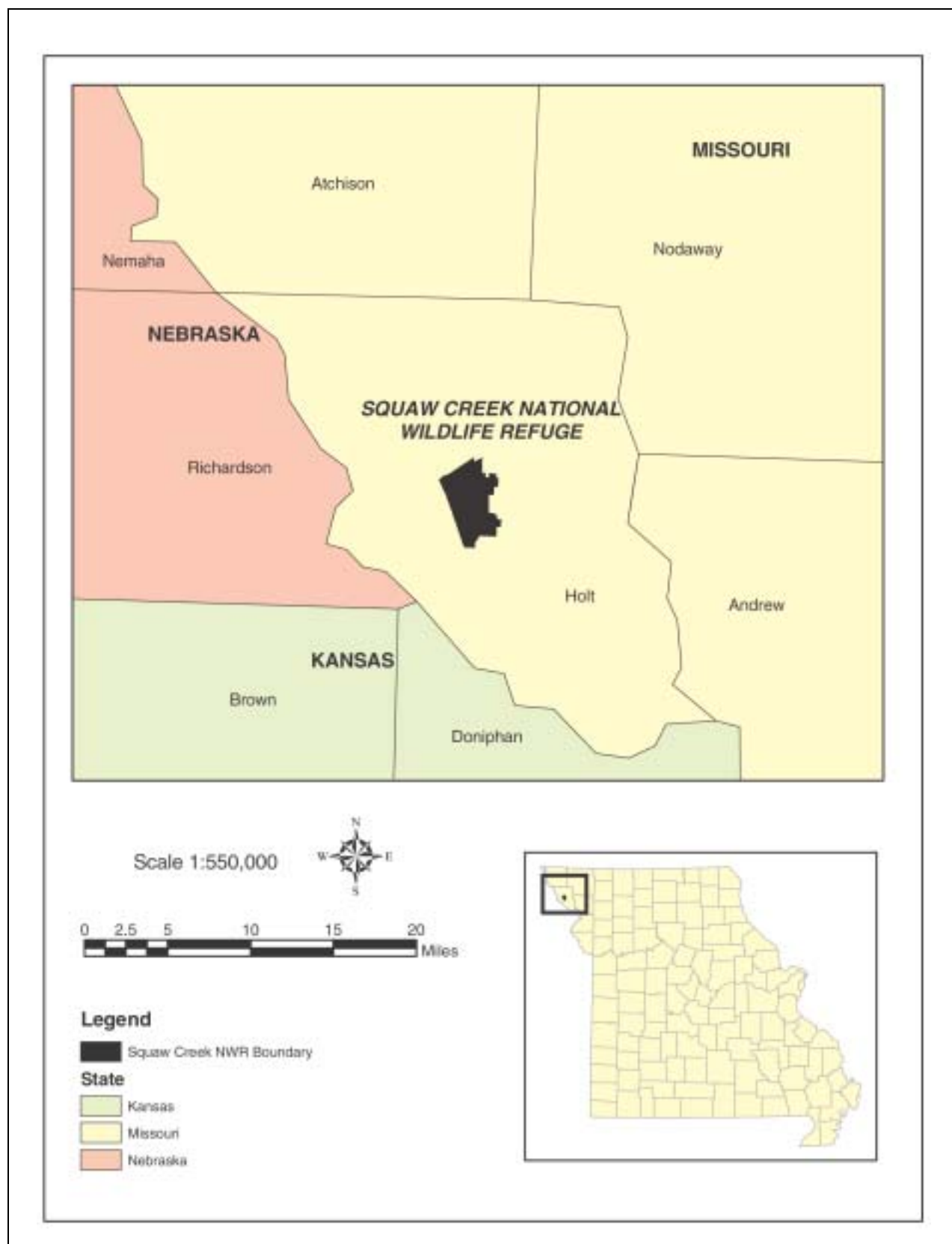
Refuge Purpose Statements are primary to the management of each refuge within the System. The Purpose Statement is derived from the legislative authority used to acquire specific refuge lands and is, along with Refuge System mission, the basis on which primary management activities are determined. Additionally, these statements are the foundation from which “allowed” uses of refuges are determined through a defined “compatibility process.”

The Refuge was established on August 23, 1935, by Executive Order 7156 of President Franklin D. Roosevelt “in order to effectuate further the purposes of the Migratory Bird Conservation Act” and the lands are to be used “as a refuge and breeding ground for migratory birds and other wildlife.” This is the formal purpose of the Refuge.

Throughout the 100-year existence of the National Wildlife Refuge System, its functional direction and purpose has evolved to reflect its ever increasing value as a collection of irreplaceable habitats representing the diverse natural heritage of America. In so doing, the purposes of individual refuges such as Squaw Creek have broadened from somewhat narrow definitions aimed at specific animal groups to include entire ecosystems and all the wildlife species and plants within them.

Other aims of Squaw Creek NWR include preserving, restoring, and managing wetland and upland habitats that represent the Lower Missouri River ecosystem for the benefit of a diverse complex of fauna and flora, with emphasis on threatened and endangered species; and providing opportunities for the public to enjoy wildlife-dependent recreation.

Figure 1: Map of Squaw Creek National Wildlife Refuge



This Environmental Assessment (EA) and the CCP are also needed to assess existing management issues, opportunities and alternatives, and then determine the best course for managing the natural resources of the Refuge. Further, this action will satisfy the legislative mandate of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a CCP for all national wildlife refuges.

This EA was prepared using guidelines of the National Environmental Policy Act of 1969. The Act requires us to examine the effects of proposed actions on the natural and human environment. This EA describes five alternatives for future Refuge management, the environmental consequences of each alternative, and our preferred management direction. Each alternative has a reasonable mix of fish and wildlife habitat prescriptions and wildlife-dependent recreational opportunities. Selection of the identified preferred alternative was based on its environmental consequences and ability to achieve the Refuge's purpose.

1.1.2 Need for Action

The following needs have been identified for Squaw Creek National Wildlife Refuge:

- There is a need to specify the kinds of habitats that can be maintained for the next 15 years.
- There is a need to address the siltation of Refuge marshes.
- There is a need to specify how the habitats of the Refuge should be managed to fulfill its purpose of providing for waterfowl and other migratory birds.
- There is a need to specify how habitats should be managed for Eastern Massasauga rattlesnakes and Bald Eagles, two species of particular concern on the Refuge.
- There is a need to specify how the Refuge can contribute to the reduction of the continental population of Snow Geese and also a need to reduce the deer population on the Refuge.
- There is a need to specify how the mandate to facilitate wildlife-dependent recreation can be fulfilled.
- In addition, a plan is needed to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the Service to develop and implement a Comprehensive Conservation Plan for all national wildlife refuges.

1.2 Decision Framework

This EA is an important step in the Service's formal decision-making process. In compliance with the National Environmental Policy Act, the Regional Director of the Great Lakes/Big Rivers Region will consider the information presented in this document to select the alternatives.

The Regional Director will determine whether the preferred alternative is a major Federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. If it is determined not to be a major Federal action, a Finding of No Significant Impact (FONSI) will be issued. A FONSI means that the preferred alternative is selected and can be implemented in accordance with other laws and regulations. A Decision of Significant Impact would indicate the need to conduct more detailed environmental analysis in an Environmental Impact Statement.

1.3 Background

1.3.1 The United States Fish and Wildlife Service

The United States Fish and Wildlife Service (Service) is the primary Federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife resources and their habitats for the continuing benefit of the American people. Some responsibilities are shared with Federal, state, tribal, and local entities, but the Service has specific responsibilities for “trust species” – which include endangered species, migratory birds, interjurisdictional fish, and certain marine mammals – as well as management and conservation of lands and waters administered by the Service.

The Service's mission is “Working with others to conserve, protect, enhance and, where appropriate restore fish, wildlife and plants and their habitats for the continuing benefit of the American people.”

The Service is guided by four principal mission goals:

Sustainability of fish and wildlife populations: Conserve, protect, restore and enhance fish, wildlife and plant populations entrusted to our care.

Habitat Conservation: A Network of Land and Waters: Cooperating with others, we will conserve an ecologically diverse network of lands and waters of various ownerships providing habitats for fish, wildlife and plant resources.

Public Use and Enjoyment: Provide opportunities to the public to enjoy, understand and participate in use and conservation of fish and wildlife resources.

Partnerships in Natural Resources: Support and strengthen partnerships with tribal, state and local governments and others in their efforts to conserve and enjoy fish, wildlife, plants and their habitats.

1.3.2 The National Wildlife Refuge System

The National Wildlife Refuge System (System) is an integral component of the Service with the mission of administering a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

The Service manages more than 535 national wildlife refuges covering more than 93 million acres that are specifically managed for fish and wildlife and their habitats. The majority of these lands, almost 83 percent of the land in the Refuge System is found in the 16 refuges in Alaska, with the remaining acres spread across the remaining 49 states and several territories. More than 88 percent of the acreage in the System was withdrawn from the Public Domain. The remainder has been acquired through purchase, transfer from other Federal agencies, as gifts, or through easement/lease agreements.

The currently proposed goals of the National Wildlife Refuge System are to:

- Fulfill our statutory duty to achieve refuge purposes and further the System mission.
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations.

- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including ecological processes characteristic of those ecosystems.
- Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

1.3.3 Squaw Creek National Wildlife Refuge

This 7,415-acre refuge includes approximately 6,700 acres of floodplain that is managed as wetland, grassland and riparian habitats that attract up to 476 Bald Eagles, 400,000 Snow Geese, and 160,000 ducks during fall and winter seasons.

The 500 acres of Refuge upland include a segment of the 200-mile long band of hills known as the Loess Hills. The Loess Hills, which were formed by wind-deposited, silt-sized soil particles, are a geologic phenomenon unique to the Missouri River Valley. While loess deposits do exist elsewhere in North America and the world, only in the Missouri River Valley are the deposits deep enough to create such an extensive land form. The Loess Hills support rare remnants of native prairie and prairie associated wildlife.

The Refuge hosts 301 species of birds, 33 mammals, and 35 reptiles and amphibians. Missouri's largest wet prairie remnant is on the Refuge and it is home to Missouri's largest meta-population of the Eastern Massasauga rattlesnake.

The quality of Squaw Creek NWR wetland habitat is affected by silt from the 60,000-acre Loess Hills watershed that is carried into the Refuge by five creeks that converge to become Squaw and Davis creeks.

1.3.4 Squaw Creek NWR Vision Statement for Desired Future Condition

For thousands of years, time in the Missouri River Basin has been measured by the migration of waterfowl. Each spring and fall, northwestern Missouri was inundated by a noisy confusion of ducks and geese. From northern Canada and the prairie pothole country, they flocked into the marshes and backwaters of wild Missouri.

However, far reaching changes have transformed the valley in the past 150 years. Marshland drainage and deepening and straightening of the channel largely eliminated oxbow lakes and marshes and the natural, sandbar-studded Missouri River channel.

In fulfilling its purpose “as a refuge and breeding ground for migratory birds and other wildlife,” the vision for the future of Squaw Creek NWR includes the following:

- Restoration and preservation of the wetland ecosystems of the Missouri River floodplain as well as the habitats native to the adjacent Loess Hills will be the major management thrust of Squaw Creek National Wildlife Refuge.
- Refuge wetlands, which includes the largest remnant wet prairie in Missouri, continue to provide safe habitat for concentrations of waterfowl and other birds during the migration and nesting seasons.
- The historic threat of wetland sedimentation has declined significantly as managers of the vast surrounding agricultural lands employ more conservative practices advocated by the Refuge staff and other agencies.

- The Refuge habitat diversity emphasizes both wetland and grassland, interspersed with stands of mixed shrubs and woodlands, managed on a scale to minimize habitat fragmentation and to be attractive to indigenous species as well as neo-tropical and passerine birds.
- Habitat diversity broadens each year as progress is made to convert former monotypic stands of reed canary grass, American lotus, and croplands to aquatic and upland species complexes that benefit both indigenous and migratory wildlife.
- Squaw Creek NWR continues to be a destination for people to enjoy wildlife-dependent recreation. Dynamic and current environmental education and interpretive displays and programs, presented in well designed facilities, help the public to understand and become supportive of the Refuge staff's efforts to conserve, preserve and manage wildlife resources and their habitats.
- The Refuge will provide wetland habitat that will support a large variety of marsh, water and shore birds with special emphasis during the spring and fall waterfowl migration. We will manage for increased use by listed and candidate federal and state endangered and threatened species, including the Bald Eagle. We will maintain white-tailed deer population levels consistent with available habitat yet provide ample viewing opportunities for the visiting public.
- The Refuge serves as an outdoor laboratory for biological researchers whose study results aid in the management for species of special concern such as the eastern Massasauga rattle snake and the Least Bittern.
- The multi-disciplined staff of biologists, technicians, and support personnel are a well trained team proficient in their functions of serving Refuge visitors, cooperators, and the general public; in their stewardship of the resources put in their charge, and in their maintenance of Refuge facilities and equipment. This team places high value on its connections with the community and relies heavily on stakeholder input.
- The Refuge budget, staff and administrative facilities are adequate to implement the strategies required to achieve the goals and objectives set forth in this plan.

1.3.5 Refuge Goals

Based on the purposes of the Refuge, the mission of the National Wildlife Refuge System and ecosystem considerations, and the vision for the Refuge, the planning team established the following goals for what we want to accomplish in the next 15 years:

Goal 1 Habitat: Manage a diversity of habitat to benefit threatened and endangered species, waterfowl, other migratory birds, and indigenous species in Lower Missouri River floodplain ecosystem and the Central Tallgrass Prairie ecosystem.

Goal 2 Wildlife: Conserve species indigenous to the Refuge, the Lower Missouri River Ecosystem, and the Central Tallgrass Prairie Ecosystem with emphasis on those species identified in the Service's Fish and Wildlife Resource Conservation Priorities.

Goal 3 People: Visitor services programs, facilities and outreach efforts will motivate nearby residents and other stakeholders to appreciate the natural resources and ecological processes and cultural resources of Squaw Creek NWR, will help achieve the objectives of the Refuge, and will support the Service's mission.

1.4 Scoping and Public Involvement

The planning process for this CCP began with a “kick-off” meeting in July 1999. Initially, members of the CCP planning team and Refuge staff identified a list of issues and concerns that were associated with management of the Refuge. These preliminary issues and concerns were based on staff knowledge of the area and association with citizens in the community. The planning team, consisting of Refuge staff and Service planners, then invited Refuge neighbors, organizations, local government agencies and local staff of national and state government agencies, schools, and interested citizens to share their thoughts in a focus group meeting on August 18, 1999. Nineteen people attended the meeting. An open house was held on September 14, 1999, and 12 attended. The planning team accepted oral and written comments at the open house. Five written comments were received.

In October 1999, the planning team met for an intensive three-day workshop to develop and consider four management alternatives that addressed the issues and concerns in different ways. The alternatives generally describe different emphases in habitat and public use management. Once alternative approaches to management were selected, methods for achieving that level were developed.

Subsequent planning team meetings in November of 1999 and January of 2000 were held with Region 3 U.S. Fish and Wildlife Service officials and biologists in Fort Snelling, Minnesota, to critique and revise these draft alternatives and associated goals and objectives. In February 2000, the planning team again met for two days at DeSoto National Wildlife Refuge to further refine goals, objectives, and strategies. The planning team met at Squaw Creek NWR in February 2003 to continue this process, resulting in this document.

1.4.1 Issues and Concerns

Issue 1. Wildlife Habitat and Resource Management

Extraordinary measures may be required to preserve the marsh environment that has historically attracted migratory waterfowl and other wildlife. Squaw Creek Refuge is a sump-like area that lies between the Missouri River on the west and the loess bluffs on the east. The steep slopes on the river side of the bluffs along with intensive agriculture result in heavy silt loads in Squaw Creek and Davis Creek that pass through the Refuge on their way to the Missouri River. While these creeks are the primary water source for the Refuge, they also dump considerable amounts of silt in the managed marsh units of the Refuge, making them steadily more shallow. These marsh areas could eventually fill completely and disappear. Deer numbers exceed the desired density of 20-25 deer per square mile, negatively impacting habitats such as understory vegetation in the bottomland forests. This negatively impacts other species of interest.

Issue 2. Land Management within the Watershed Impacts Refuge Water Quality and Quantity

While neither the Refuge nor the Fish and Wildlife Service has any interest or authority to interfere with private lands management, they do have the responsibility to conserve the public resources placed in their care. The Refuge is at the bottom of a 60,000-acre watershed. Land management practices within the watershed influence quality and quantity of water that flows into the Refuge. Unrestricted surface runoff in the watershed depletes top soil and soil moisture conditions. The deposition of top soil and agricultural chemicals in the Refuge marshes during flood stages has an adverse cumulative effect. There are existing cost share programs available to landowners aimed at improved soil and moisture conservation.

Issue 3. Snow Goose Management

The mid-continent population of Snow Geese and Ross' Geese are in trouble because there are too many – what some refer to as “a perilous abundance.” The peril is their numbers. The estimate of

Snow and Ross' Geese in the central and eastern arctic increased from 1.1 million in 1973 to 5.8 million in 1998. These geese now exceed the carrying capacity of habitats on several breeding colony sites in northern Canada. Overgrazing and grubbing by geese causes a removal of the vegetative mat that insulates underlying sediments. Exposure of sediments causes an increase in the rate of evaporation and greater concentration of inorganic salts from marine clays. Increased soil salinity eventually eliminates growth of the salt-marsh community and desertification ensues. Bare mudflats may become colonized by salt-tolerant plants, which are utilized by few, if any, wildlife species.

Recovery of damaged Arctic tundra vegetation is extremely slow and tends to continue towards self destruction once the moisture and chemical balance is upset. High Snow Geese survival rates over the last 20 years and high quality wintering grounds has contributed to the over population. Action plans developed by both the Canadian and U.S. Fish and Wildlife Service and State and Provincial agencies focus on reducing the Snow Goose population.

Concentrations of 300,000 to 400,000 Snow Geese at Squaw Creek NWR during the fall migration has become a sight-seeing tradition that attracts thousands of Refuge visitors. The Snow Geese are also welcomed by waterfowl hunters in an area from Sioux City, Iowa to Kansas City, Missouri. The large concentrations of geese on the Refuge provides significant hunting opportunity on adjacent public and private hunting areas. There is concern that opening the Refuge to more hunting would not only scare the geese out of the area, reducing overall hunting opportunity and the associated take of birds, but also restrict other public use such as the auto tour route and wildlife observation areas. Others felt some goose hunting on the Refuge would help address the mid-continent Snow Goose over-abundance.

Issue 4. Refuge Expansion

Floodplain wetlands similar to those within Squaw Creek NWR have been preserved and managed as private and commercial waterfowl hunting clubs. High operations costs have caused some owners to consider selling their property to the Refuge. Some of the Refuge marsh restoration and preservation problems associated with watershed management and runoff might be lessened if some of the adjacent agricultural land was added to the Refuge and converted to other uses. However, hydrological and biological data supporting this is incomplete or lacking.

Issue 5. Public Use

Public use at the Refuge has focused on nonconsumptive uses and wildlife dependent recreation, but some people have suggested that the Refuge's public use program should be changed to allow other compatible uses that might include hunting waterfowl and deer. Currently there is a special two-day muzzle loader deer hunt with a specific number of permits issued. Angling is allowed where the roads cross the creek ditches. Historically, environmental education has been emphasized at Squaw Creek NWR.

Issue 6. Public Service

The staff at Squaw Creek NWR want to be good neighbors and contributors to the welfare of the community. Public benefits now include environmental education programs for schools and special groups both on and off the Refuge, disaster assistance with staff and equipment, operations budgets that boost the local economy, annual payments to counties to offset losses of real property tax revenues, cost share programs for environmental improvements on private lands, and attraction of visitors who patronize local businesses. As the Refuge strives to be of service to the public and the community, are there new or better ways it can be successful in its efforts?

1.5 Legal, Policy, And Administrative Guidelines

1.5.1 Legal Mandates

Administration of refuges is guided by laws, Executive Orders, and Service policy. A list of pertinent statutes and policy guidance can be found in Appendix E of the draft CCP, “Compliance Requirements.”

Chapter 2: Description of Alternatives

This chapter describes five alternatives analyzed for the Squaw Creek NWR, including Alternative D, the proposed action.

2.1 Rationale for Alternative Designs

Each alternative was formulated with the understanding that it must be capable of achieving all Refuge goals. Each alternative will achieve the goals, but to varying degrees. The focus of the alternatives is on the habitats, visitor use opportunities, or both. All alternatives consider the potential for the land to sustain specific habitats and visitor uses.

2.2 Alternatives Considered But Not Analyzed in Detail

Expansion of the Refuge was considered as a possible alternative. The primary purpose of an expansion would be to provide an additional tool to deal with the adverse affects of the silt and sediment that originate in the 95 square miles of watersheds that drain through the Refuge. The Refuge's ability to control water passing through the Refuge during high sediment load periods would conserve Refuge habitats from the negative impacts of sediment accumulation to some degree. But these measures would likely only delay the eventual total siltation of the wetland basins. To effectively deal with the problem, the sediment load entering the Refuge must be reduced significantly. We considered an expansion of the Refuge that would take place within a 43,300-acre watershed. Within that area, we considered the possibility of acquiring easements from willing sellers only. The easements would allow Refuge staff to establish permanent grassland or woody cover in erodible areas or to permanently conserve areas of existing cover. The land would remain in private ownership with the requirement that the cover encompassed by the easement be preserved permanently. While it was unlikely that the entire easement acreage would ever be acquired, because the program would function on a willing seller basis only, we thought that it would be important that an adequately large area be available to increase the chance that there are willing sellers interested in participating. We estimated that 2,500 to 4,500 acres of easements could be obtained over the next 15 years.

In addition to the easements in the watershed, we considered acquiring full interests in certain lands adjacent to the Refuge as an alternative. To the west and north of the Refuge, up to 11,000 acres could be acquired to provide additional wetland, grassland, and bottomland forest habitat restoration opportunities. We speculated that these lands would benefit Eastern Massassauga rattlesnakes and affect the hydrology of the area by increasing the recharge of ground water, which would help water management on the Refuge.

To the southeast, approximately 5,700 acres in the Loess Hills could be acquired to preserve those rare habitats and to complement existing Refuge habitat. We estimated that approximately 4,500

acres could be acquired in these two areas within the next 15 years. Like the easements, lands would be acquired only from willing sellers.

We did not evaluate the possible expansion alternatives in detail because we felt that we did not have enough background data and that additional studies are needed before an expansion can be reasonably evaluated. In the comprehensive conservation plan, strategies address obtaining enough data to better evaluate potential expansion of the Refuge. There are still approximately 400 acres to be acquired within the currently authorized Refuge boundaries.

2.3 Description of Alternatives

The alternatives are compared and summarized by goal in Table 1. A more detailed comparison of alternatives by specific objectives and general strategies can be found in Appendix K of the Draft Comprehensive Conservation Plan. Archaeological and cultural values would be protected as mandated by law under all alternatives.

2.3.1 Alternative A: Current Management Practices (No Action)

Under this alternative there would be no major change in Refuge goals, objectives, and strategies. Some strategies would be revised to incorporate improved techniques, which have been learned from current management practices. The current goals and objectives call for maintenance and modest enhancement of wetland habitat, upland habitat, fish and wildlife populations, public use, resource conservation, facilities, work force and administration. This alternative does not fully address long-term needs and issues such as constant sedimentation in the wetland management units, the mid-continent Snow Goose population problem, and land acquisition that would allow increased preservation and restoration of the Missouri River floodplain habitat.

Additional information describing this alternative can be found in Table 1.

2.3.2 Alternative B: Restore Historic Wet and Mesic Prairie

Squaw Creek NWR presently contains the largest remaining wet prairie remnant in public ownership in Missouri. Wet prairie is an important habitat for several State-listed threatened and endangered species, including the Massasauga rattlesnake. This alternative would attempt to expand the present wet prairie, restore the wet prairie vegetation and reintroduce fauna found prior to the mid-1840's in the Missouri River ecosystem. The restored area would be a showcase example of the historic conditions, particularly relevant on the 200th anniversary of the Lewis and Clark expedition, and would be of great interpretive value to visitors.

Some of the current management practices would be altered or eliminated. Prescribed burning frequencies and seasons would be changed to more accurately reflect natural burns. Active water level manipulations would be eliminated and the natural seasonal ebb and flow via watershed runoff would be encouraged. Farming and vegetative habitat management (mowing, haying, chemical spraying) would be eliminated to permit natural ecological successional changes to occur.

Additional information describing this alternative can be found in Table 1.

Table 1: Comparison of Alternatives by Refuge Goals

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 1: Habitat <i>Manage a diversity of habitat to benefit threatened and endangered species, waterfowl, other migratory birds, and indigenous species in Lower Missouri River floodplain ecosystem and the Central Tallgrass Prairie Ecosystem</i>	3,409 acres of managed wetlands.	1,227 acres of managed wetlands.	Same as Alternative A	3,452 acres of managed wetlands.	Same as Alternative A
	176 acres of semi-natural wetlands.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	1,077 acres of wet prairie.	3,259 acres of wet prairie.	Same as Alternative A	Same as Alternative A	Same as Alternative A
	291 acres of bottomland mesic prairie	870 acres of bottomland mesic prairie.	Same as Alternative A	508 acres of bottomland mesic prairie.	570 acres of bottomland mesic prairie.
	221 acres of Loess Hill prairie.	Same as Alternative A	Same as Alternative A	299 acres of Loess Hill prairie.	Same as Alternative A
	378 acres of Loess Hill forest.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	1,000 acres of bottomland forest.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	579 acres of cropland, 59 acres of old field (no change from current management).	0 acres cropland.	Same as Alternative A	300 acres of cropland, 0 acres of old field.	Same as Alternative D
	Control exotic, invasive and nuisance species.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	400 acres within existing authorized boundaries.	Same as Alternative A	Same as Alternative A	Same as Alternative a	Same as Alternative A
	Reduce watershed sediment entering the Refuge.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Manage Wildlife Management District lands to benefit soil and water conservation and associated wildlife.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 1: Comparison of Alternatives by Refuge Goals (Continued)

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 2: Wildlife <i>Conserve species indigenous to the Refuge, the Lower Missouri River floodplain ecosystem, and the Central Tallgrass Prairie Ecosystem with emphasis on those species identified in the Service's Fish and Wildlife Resource Conservation Priorities.</i>	Western Hemispheric Shore Bird Designation will be sought.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Wildlife populations will be surveyed and monitored.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	5 million waterfowl use days.	2 million waterfowl use days.	Same as Alternative A	Same as Alternative A	5.3 million waterfowl use days.
	Reduce Snow Goose numbers primarily be discouraging cropland use of the Refuge and by providing a roosting site that holds birds in the area for hunting around the Refuge.	Same as Alternative A, with the exception that cropland is eliminated completely under this alternative, thereby having a greater impact on Snow Geese.	Same as Alternative A	Same as Alternative A, with the exception that there is a spring Snow Goose hunt and cropland is reduced.	Same as Alternative A, with the exception that there is a greater reduction in Snow Goose numbers.
	Deer numbers will be regulated through a managed hunt.	Same as Alternative A	Same as Alternative A	Same as Alternative A, with one accessible deer blind added and permit system adjusted to allow more deer taken when necessary.	Same as Alternative A
	Maintain Bald Eagle habitat.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 1: Comparison of Alternatives by Refuge Goals (Continued)

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
	Monitor Eastern massasauga rattlesnake numbers and distribution and maintain 1,077 acres wet prairie.	Same as Alternative A, but increase wet prairie to 3,259 acres.	Same as Alternative A	Same as Alternative A, but mesic prairie increased by 217 acres to 508 acres total.	Same as Alternative A
	Least Bittern populations will be monitored and habitat will be maintained.	Same as Alternative A, but 349 acres of hemi-marsh provided.	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Support conservation of priority passerine species.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Report sightings of state species of concern to the MDOC.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
Goal 3: People <i>Visitors and nearby residents will appreciate the natural resources, ecological processes and cultural resources of Squaw Creek NWR and will support the Service's mission.</i>	Minor improvement in environmental interpretation materials and programs; accommodate 130,000 visitors annually.	Same as Alternative A	Increased environmental interpretation efforts; trail extension; brochure revision; accommodate 175,000 visitors annually.	Same as Alternative C with the exception that the Refuge would accommodate 130,000 visitors annually.	Same as Alternative A
	Environmental education programming at the 2004 level.	Same as Alternative A	Enhanced environmental education efforts to accommodate 6,000 students annually, add boardwalk, teacher workshops.	Same as Alternative C	Same as Alternative A
	Wildlife observation and photography programs at 2004 level and existing facilities.	Same as Alternative A	Extend trail, observation blind, add pull-offs on the Auto Tour route.	Same as Alternative C	Same as Alternative A
	Hunting and fishing: 135 deer hunters per year; bank fishing in select areas.	Same as Alternative A	135 deer hunters, spring goose hunt, accessible deer blind.	Same as Alternative C	Same as Alternative A
	Public information at 2004 level.	Same as Alternative A	Expanded public information effort.	Same as Alternative C	Same as Alternative A

Table 1: Comparison of Alternatives by Refuge Goals (Continued)

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
	Maintain and enhance relations with Friends of Squaw Creek NWR.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Involvement with government agencies and non-government organizations at 2004 level.	Same as Alternative A	Additional efforts to work with government agencies and non-government organizations.	Same as Alternative C	Same as Alternative A
	Actively support and encourage research on the Refuge.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A

2.3.3 Alternative C: Enhance Public Use/Current Resource Management Level

Under this alternative, the six priority wildlife-dependent uses highlighted in the Refuge Improvement Act would be promoted and enhanced. These uses include hunting, fishing, environmental education and interpretation, and wildlife observation and photography. Environmental education efforts and outreach would be stepped up considerably. Additional facilities would be developed on the Refuge to accommodate increased public use.

Additional information describing this alternative can be found in Table 1.

2.3.4 Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)

This alternative seeks to maximize wildlife habitat and population management practices and opportunities without adversely impacting current levels of wildlife-dependent recreational opportunities. Compared to Alternative A, a greater effort would be made toward conserving, managing, and restoring habitats native to the Lower Missouri River ecosystem, both on Refuge lands and FSA easements within the management district and watershed. Management would include additional wetland, riparian, and native grass development and enhancement. Increased biological monitoring would evaluate wildlife responses to management efforts and track population trends of species of concern, including Massasauga rattlesnakes and grasslands birds. We would seek to quantify the need and benefit of various approaches to reducing sedimentation and improving water quality. Additional efforts would be made to accommodate all migratory bird species, such as fall migrating shorebirds. Snow Goose populations would be actively managed, which for the immediate future means participating in the mid-continent efforts of population reduction.

All wildlife-dependent recreational opportunities would continue as in Alternative A, but with a slight additional effort exerted to increase visitation or additional public use activities and improvement in the quality of services and facilities.

Additional information describing this alternative can be found in Table 1.

2.3.5 Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation

This alternative would selectively emphasize the creation and maintenance of the widest possible variety of wetland habitats (e.g. lacustrine, palustrine, moist soil, green tree, riverine, bottomland hardwoods, wet meadows, exposed flats, and others) with the intention of attracting highly diverse populations of aquatic wildlife. Targeted wildlife species would include waterfowl (e.g. ducks, and geese), shorebirds and wading birds, aquatic animals and plants that are of high interest to the public (e.g., otters), and species that require additional conservation (e.g., rare, threatened or endangered species of aquatic plants and animals).

The Refuge would be maintained as a showcase of Lower Missouri River Ecosystem wetland habitats and aquatic wildlife diversity. The value of this alternative would include conservation/preservation, public education, and scientific research. Outreach and education activities would focus on helping people understand the importance of wetlands. The alternative would include demonstration areas to teach the public how to create and maintain wetlands.

Under this alternative, visitor numbers and programs would be restricted to minimize conflicts with the wetlands management and aquatic biodiversity conservation goals.

Under this alternative, extreme measures may be necessary to maintain various habitat types. These measures might include dredging and constructing dikes and water control structures.

Additional information describing this alternative can be found in Tables 1 and Appendix K.

2.3.6 Elements Common to All Alternatives

2.3.6.1 Fire

Under each alternative we propose to adopt the Fire Management Plan for the Refuge, which was drafted in 2002 and is available at the Refuge Office for inspection.

2.3.6.1.1 Prescribed Fire

Prescribed fire is a habitat management tool that is used on the Refuge regularly. Refuge staff annually burn areas of the Refuge to enhance habitat for upland game, waterfowl, and other species of interest. The periodic burning of grasslands and sedge meadows reduces encroaching vegetation such as willow. It also encourages the growth of desirable species such as cord grass.

All prescribed burns are carried out by highly trained and qualified personnel who perform the operation under very precise plans. The Refuge has an approved fire management plan that describes in detail how prescribed burning will be conducted on the Refuge. No burning takes place unless it meets the qualifications of the prescription for each burn unit. A prescription is a set of parameters that define the air temperature, fuel moisture, wind direction and velocity, soil moisture, relative humidity, and several other environmental factors under which a prescribed burn may be ignited. This insures that there is minimal chance the fire will escape the unit boundaries and that the fire will have the desired effect on the plant community.

Prescribed burns will occasionally be conducted within or near Refuge development zones, sensitive resources, and boundaries to reduce the risk from wildfire. To the greatest extent possible, prescribed fires to reduce hazards will only be used when they complement resource management objectives.

Combustion of fuels during prescribed fire operations may temporarily impact air quality, but the impacts are mitigated by small burn unit size, the direction of winds the burns are conducted with, and the distance from population centers. All efforts will be taken to assure that smoke does not impact smoke sensitive areas such as roads and local residences.

Burn frequency will vary from every 3 to 5 years or longer on established grassland, savanna, and wet prairie units depending on management objectives, historic fire frequency, and funding. As part of the prescribed fire program, a literature search will be conducted to determine the effects of fire on various plant and animal species, and a monitoring program will be instituted to verify that objectives are being achieved.

Prescribed fires cannot and will not be ignited when the area is at an extreme fire danger level and/or the National Preparedness level is V, without the approval of the Regional Fire Management Coordinator. In addition, the Refuge will not ignite prescribed fires without the applicable State concurrence when the county or the State has instituted a burning ban.

Drought can have an effect on fire severity and control. One or more drought indicators (PDI - KBI) will be used to determine the degree of drought. These indicators can be accessed on the web at <http://www.boi.noaa.gov/fwweb/fwoutlook.htm>

Spot fires, slop-overs, and escapes can be an expected occurrence on any prescribed fire. They can be caused by any of a number of factors that can not always be accounted for in the planning process. A few minor occurrences of these events on a prescribed burn can usually be controlled by the burn crew. If so, they do not constitute a wildfire. The burn boss is responsible for evaluating the frequency and severity of these events and taking mitigating measures such as slowing down or stopping the burn operation, ordering additional holding forces from within Refuge staff, or taking measures to extinguish the prescribed burn. Should an escape exceed the ability of existing holding forces to control, and additional assistance becomes necessary in the form of State agency involvement, the event will be classified a wildfire and controlled accordingly. Once controlled by these forces, the prescribed burning operation will be stopped for the burning period. A fire number will be obtained to implement wildfire funding to cover the cost of control, a wildfire report will be generated and a Wildland Fire Situation Analysis will be prepared.

Prescribed burns can be conducted at any time of year depending on resource objectives and prescription. However, the normal prescribed fire season begins approximately April 1 and ends by May 31, due to early bird nesting. Fall burning may begin again August 15 and end October 31.

Precautions will be taken to protect threatened and endangered species during prescribed burning. Nesting trees for Bald Eagles will be protected and burning will not be conducted at a time or in a way to negatively impact any nesting eagles. If any of the known populations of Massasauga rattlesnake are in or near a burn unit, precautions will be taken to avoid the reptiles.

Existing firebreaks will be used. They may undergo minor improvements such as rotoation (vegetation disruption). General policy dictates that any new firebreaks or below surface improvements to existing firebreaks will be approved by the Regional Historic Preservation Officer.

The Refuge Biologists will be responsible for supervising the development of resource management objectives for individual units. The Refuge staff will provide assistance in the selection of the appropriate management tool needed to meet objectives. Prescribed fire is just one of a combination of tools available. If needed, the Zone Fire Management Officer (Zone FMO) will be consulted for assistance in developing a prescription that will achieve the desired results.

Burn plans (the Fire Management Plan) are written to document the treatment objectives, the prescription, and the plan of action for carrying out the burn. Burn plans are written by or under the guidance of a qualified burn boss. The burn plan follows the format in the Service's Fire Management Handbook or a format approved by the Regional Fire Management Coordinator and addresses all aspects as specified in the Service's Fire Management Handbook. Details regarding fire resources and procedures may be found in the Refuge Fire Plan. All burn plans are reviewed by the Refuge Manager, Zone FMO, and approved by the individual Refuge Managers prior to implementation.

2.3.6.1.2 Fire Prevention and Detection

Although fire may have historically played a role in the development of habitats on the Refuge, human ignited fires and natural ignitions burning without a prescription are likely to result in unwanted damage to cultural and/or natural resources. In order to prevent wildfire, an educational program will be utilized to reduce the threat of human caused fires. Ongoing monitoring will be conducted by Refuge staff, visitors, and cooperators to detect fire ignitions. Actions taken to implement this include:

- Fire prevention will be discussed at safety meetings, prior to the fire season, and during periods of high fire danger. Periodic training of staff in regard to fire prevention will be conducted.

- During periods of extreme fire danger, warnings will be posted at visitor information stations.
- Public contacts will be made via press releases and verbal contacts during periods of extreme fire danger.
- A thorough investigation will be conducted of all fires suspected to have been illegally set. Upon completion of the investigation, appropriate action will be taken.
- The Refuge relies on neighbors, visitors, cooperators, and staff to detect and report fires. In addition, the step-down plan provides for increased patrols by Refuge personnel during periods of very high and extreme fire danger.
- All fires occurring within or adjacent to (within 2 miles) the individual Refuges will be reported to the respective Refuge headquarters. The person receiving the report will be responsible for implementing the Fire Dispatch Plan and assume duties of Fire Dispatcher until relieved or released.
- For local fires, the Fire Dispatcher will stay on duty until: (1) all Refuge resources return; (2) relieved by another dispatcher; or (3) advised by IC that he/she can leave. The Fire Dispatcher will not be required to stay on duty if the fire occurs outside Refuge radio coverage but before leaving the dispatcher must notify the applicable State Dispatcher that a Dispatcher is not on duty at the Refuge.
- The Fire Dispatcher will be responsible for coordinating the filling and delivery of any resource orders made by the Incident Commander (IC) for all operational and logistical needs, including engines, aircraft, tools, supplies, and meals. The IC will place all resource orders through the Dispatcher, and specify what is needed, when it is needed, and where it is needed. The Dispatcher will promptly determine if the resource orders can be filled or procured locally and notify the IC. If a resource order can not be filled locally, the Dispatcher will place the order with the Interagency Fire Dispatcher in. The Zone FMO for the Refuge will generally be able to assist with ordering resources from outside the area.
- Requests for assistance by cooperators on fires not threatening an individual Refuge must be made to the Refuge Manager or designee. Only qualified and properly equipped resources meeting National Wildfire Coordinating Group (NWCG) standards will be dispatched off of the Refuge.
- Firefighter and public safety always take precedence over property and resource protection during any fire management activity. Under moderate to severe fire danger index ratings, flaming fronts are capable of moving at fast speeds in all fuel models. In order to eliminate safety hazards to the public, all public access into the burn units will be closed the day of the burn. Fire crews will be briefed that should an individual who is not a member of the fire crew be observed in the prescribed burn unit, they will be immediately escorted out of the area. The fire crew will keep the fire scene clear of people except for Service firefighters and cooperating fire crews.

2.3.6.1.3 Fire Suppression

Service policy requires the Refuge to utilize the Incident Command System (ICS) and firefighters meeting NWCG qualifications for fires occurring on Refuge property. All suppression efforts will be directed toward safeguarding life while protecting the Refuge's resources and property from harm. Mutual aid resources responding from Cooperating Agencies will not be required to meet NWCG standards, but must meet the standards of their Agency. Mutual aid resources will report to the Incident Commander (IC) in person or by radio and receive their duty assignment. Mutual aid forces will be first priority for release from the fire. If additional firefighters are needed, appropriate procedures will be used to acquire them.

All fires occurring on the Refuge and staffed with Service employees will be supervised by a qualified IC. The IC will be responsible for all management aspects of the fire. If a qualified IC is not available, one will be ordered through the appropriate area office dispatch center. All resources will report to the IC (either in person or by radio) prior to deploying to the fire and upon arrival to the fire. The IC will be responsible for: (1) providing a size-up of the fire to dispatch as soon as possible; (2) determine the resources needed for the fire; and (3) advising dispatch of resource needs on the fire. The IC will receive general suppression strategy from the Fire Management Plan, but appropriate tactics used to suppress the fire will be up to the IC to implement. Minimum impact suppression tactics (MIST) will be used whenever possible.

Severity funding may be essential to provide adequate fire protection for the Refuge during periods of drought, as defined by the Palmer Drought Index or other appropriate drought indicators. Severity funds may be used to hire additional firefighters, extend firefighter seasons, or to provide additional resources. The Service Fire Management Handbook provides guidelines for use of severity funding.

The incident commander (IC) on a wildland fire or the prescribed fire burn boss on a prescribed burn will be responsible for the completion of a DI-1202 Fire Report as well as Crew Time Reports for all personnel assigned to an incident and return these reports to the Assistant Manager. The IC or burn boss should include a list of all expenses and/or items lost on the fire and a list of personnel assignments on the DI-1202. The Zone FMO will enter all data into the FMIS computer database within 10 days after the fire is declared out. The Zone FMO will also inform the timekeeper of all time and premium pay to be charged to the fire and ensure expended supplies are replaced. In addition, the following provisions will apply:

- Utilize existing roads and trails, bodies of water, areas of sparse or non-continuous fuels as primary control lines, anchor points, escape routes, and safety zones.
- When appropriate, conduct backfiring operations from existing roads and natural barriers to halt the spread of fire.
- Use burnouts to stabilize and strengthen the primary control lines.
- Depending upon the situation, either direct or indirect attack methods may be employed. The use of backfire in combination with allowing the wildfire to burn to a road or natural firebreak would be least damaging to the environment. However direct attack by constructing control lines as close to the fire as possible may be the preferred method to establish quicker control.
- Retardants may be used on upland areas.
- Constructed fire line will be rehabilitated prior to departure from the fire or scheduled for rehabilitation by other non-fire personnel.
- The Incident Commander will choose the appropriate suppression strategy and technique. As a guide: On low intensity fires (generally flame lengths less than 4 feet) the primary suppression strategy will be direct attack with hand crews and engines. If conditions occur that sustain higher intensity fires (those with flame lengths greater than 4 feet) then indirect strategies that utilize back fires or burning out from natural and human-made fire barriers may be utilized. Those barriers should be selected to safely suppress the fire, minimize resource degradation and damage and be cost effective.
- The use of earth-moving equipment for suppression activities (dozers, graders, plows) on the Refuge will not be permitted without the approval of the individual Refuge Manager or his/her designated representative in the event of their absence.
- All areas in which wildfires occur on the Refuge or Refuge administered lands will be evaluated prior to the aerial or ground application of foams and/or retardants. Only

approved chemical foams and retardants will be used (or not used) in sensitive areas such as those with riparian vegetation.

- Hazard reduction prescribed fires may be used in fire adapted communities that have not had significant fire for more than twice the normal fire frequency for that community type.
- Utilization of heavy equipment during high intensity fires will be allowed only with the approval of the individual Refuge managers of the Refuge.
- Wild fire use for resource benefit will not be utilized.
- Engines will remain on roads and trails to the fullest extent possible.
- Whenever it appears a fire will escape initial attack efforts, leave Service lands, or when fire complexity exceeds the capabilities of command or operations, the IC will take appropriate, proactive actions to ensure additional resources are ordered. The IC, through dispatch or other means, will notify the Refuge FMO of the situation. With Zone FMO assistance the Refuge Manager will complete a Wildland Fire Situation Analysis (WFSA) and Delegation of Authority.
- The IC will be responsible for mop-up and rehabilitation actions and standards on Refuge fires. Refuge fires will be monitored until declared out.
- Rehabilitation of suppression actions will take place prior to firefighters being released from the fire. Action to be taken include: 1) All trash will be removed; 2) Fire lines will be refilled and water bars added if needed; 3) Hazardous trees and snags cut and all stumps cut flush; and 4) Damage to improvements caused by suppression efforts will be repaired, and a rehabilitation plan completed if necessary. Service policy states that only damage to improvements caused by suppression efforts can be repaired with fire funds. Service funds cannot be used to repair damage caused by the fire itself (i.e. burnt fence lines). If re-seeding is necessary, it will be accomplished according to Service policy and regulations.

2.3.6.2 Listed Species and Other Species of Interest

Chapter 3 of this EA describes the current status of fish and wildlife in and near the Refuge. The discussion highlights one threatened species (Bald Eagle) found on the Refuge in addition to other species of interest described in Chapter 3. In all alternatives the present acreage of bottomland forest and mature cottonwood stands are maintained for Bald Eagles. The current acreage of wet prairie, which benefits eastern Massassauga rattlesnakes, is maintained in all alternatives, except Alternative B where the acreage increases.

Section 7 of the Endangered Species Act outlines a mechanism for ensuring that actions taken by Federal agencies do not jeopardize the existence of any listed species. We are conducting a "Section 7" review concurrent with the Review of the draft CCP.

2.3.6.3 Archaeological and Cultural Resource Values

As part of its larger conservation mandate and ethic, the Service through the Refuge Manager applies several historic preservation laws and regulations to ensure historic properties are identified and are protected to the extent possible within its established purposes and Refuge System mission.

The Refuge Manager early in project planning for all undertakings, informs the RHPO (Regional Historic Preservation Officer) to initiate the Section 106 process. Concurrent with public notification and involvement for environmental compliance and compatibility determinations if applicable, or cultural resources only if no other issues are involved, the Refuge Manager informs and requests comments from the public and local officials through presentations, meetings, and media notices; results are provided to the RHPO.

When the Service and one or more other Federal agencies have Section 106 responsibilities, the Service initiates the procedures in 36 CFR Part 800 independently of other agencies unless a lead Federal agency has been determined.

Archeological investigations and collecting are performed only in the public interest by qualified archeologists or by persons recommended by the Governor working under an Archaeological Resources Protection Act permit issued by the Regional Director. The Refuge Manager has found this third-party use of Refuge land to be compatible. The requirements of ARPA apply to Service cultural resources contracts; the contract is the equivalent of a permit. The Refuge Manager issues special permits for archeological investigations. Refuge personnel take steps to prevent unauthorized collecting by the public, contractors, and Refuge personnel; violators are cited or other appropriate action taken. Violations are reported to the Regional Historic Preservation Officer.

Chapter 3: Affected Environment

3.1 Description Of Squaw Creek National Wildlife Refuge

This chapter provides a brief introduction to the existing physical and social environment of Squaw Creek NWR, including the location, size and habitat of the Refuge, geomorphology, sedimentation and water quality, soils, habitat, wildlife, public use activities, the social environment and cultural resources that are known to exist on Refuge lands. Greater detail on the affected environment is provided in Chapter 3 of the draft comprehensive conservation plan.

The Refuge is a 7,415-acre area of wetlands, wet and mesic prairie, bottomland forest, and upland forest. It lies in the floodplain of the Missouri River and extends into the hillside prairie and woodlands of the Loess Hills of northwestern Missouri.

3.2 Habitat Overview

Squaw Creek NWR is part of what once was a large natural marsh in the Missouri River floodplain and historically was heavily used by waterfowl and other migratory birds during their spring and fall migrations. Today, the Refuge supports a diverse array of upland and floodplain habitat. Habitats include islands, marshes, moist soil, open waters, bottomland forests, croplands, wet and mesic prairie, and upland forest that assist a variety of birds, mammals, amphibians, reptiles and fish in their life cycles.

Throughout the area surrounding the Refuge, the most historically prevalent and now highly impacted habitat types are wet and mesic prairie, bottomland and upland forest, and aquatic vegetation.

Trees and other plants include Eastern red cedar, Eastern cottonwood, black willow, silver maple, smooth sumac, coralberry, false indigo, swamp milkweed, blue wild indigo, swamp buttercup, monkeyflower, blue lobelia, downy painted cup (Indian paintbrush), prairie larkspur, dotted blazing star, hoary puccoon, round-headed bush-clover, soaptree yucca, prairie ragwort, goldenrods, sunflowers, asters, and numerous grasses (including big and little bluestems, and hairy grama).

3.2.1 Forested Resources

The Refuge has approximately 1,000 acres of bottomland forest and 375 acres of loess hill forest. Common trees on the Refuge include Eastern red cedar, Eastern cottonwood, black willow, and silver maple.

3.2.2 Wetland Resources

The Refuge is impounded by a dam. Water management within this main dam is a result of small dikes and levees that subdivide the wetlands into marshes and moist soil units. The compartmentalizing counters the effects of long term siltation within the upper end of the large marsh created in the early 1940's. In addition to the managed wetlands, there are about 175 acres of semi-natural wetlands on the Refuge.

The Refuge contains 15 independently managed marshes in 10 designated pools of approximately 3,400 acres and 14 independently managed lowlands in three designated moist soil units of approximately 350 acres. Water levels are manipulated in each of the marshes and moist soil units to provide water depths and vegetative conditions attractive to spring and fall migrating waterfowl as well as to provide nesting habitat for waterfowl and a variety of marsh and water birds during the summer. The moist soil units are drawn down to encourage moist soil plant production and/or to prescribe burn and to permit mechanical vegetative control.

3.2.3 Grassland Resources

Grasslands on the Refuge consist of approximately 290 acres of bottomland mesic prairie, 220 acres of loess hill prairie, and 1,077 acres of wet prairie.

The diversity of plants on the Refuge includes such plants as smooth sumac, coralberry, false indigo, swamp milkweed, blue wild indigo, swamp buttercup, monkeyflower, blue lobelia, downy painted cup (Indian paintbrush), prairie larkspur, dotted blazing star, hoary puccoon, round-headed bush-clover, soap tree yucca, prairie ragwort, goldenrods, sunflowers, asters, and numerous grasses (including big and little bluestems, and hairy grama). The Refuge also features "Wildflower Gardens at Squaw Creek," plantings around the Visitor Center of native tallgrass-prairie and woodland wildflowers, grasses, and other plants. Among these species are Dutchman's breeches, wild columbine, prairie smoke, blue-eyed grass, showy evening primrose, wild sweet-William (Phlox), Solomon's-seal, mayapple, Jack-in-the-pulpit, beardtongue, butterflyweed, lead plant, rose verbena, spiderwort, black-eyed Susan, coneflowers, wild petunia, queen-of-the-prairie, shrubby St. John's-wort, rattlesnake master, and white snakeroot.

3.2.4 Invasive Species

Non-native mammals, birds, insects, mollusks, fish and plants have been introduced to the Refuge during the past 100 years. Exotic, invasive or alien species cause vast ecological and economic damage, sometimes impacting human health. These species range across almost every ecosystem of the country. Invading species are usually very successful when introduced to a new environment because they have no natural enemies, and they can usually find a niche to exploit.

Many areas of the Squaw Creek NWR have noxious and exotic weeds that are controlled biologically, mechanically, physically or, when necessary, chemically. Missouri has State noxious weed laws that require public land managers to control specific weeds including marijuana (*Cannabis sativa*), musk thistle (*Carduus nutans* L.), Canada thistle (*Cirsium arvense*), Johnson grass (*Sorghum halepense*), field bindweed (*Convolvulus arvensis*) and purple loosestrife (*Lythrum salicaria*).

The Service has made prevention and control of invasive plant and animal species a top priority. It is the policy of the Department of Interior, the Service and Region 3 that all reasonable steps should be taken to minimize or, when feasible, eliminate dependence on chemical pest control agents. Reduction of chemical usage on Service lands is unquestionably the best thing to do for the resources in our care.

3.2.5 Sedimentation and Water Quality

Water resources for the Refuge include gravity flow from Squaw Creek, gravity flow from Davis Creek, and a well and pump on the Rice Paddy moist soil unit and in Mallard Marsh. Silt from the five creeks that converge to become Squaw Creek and Davis Creek is a primary concern for the Refuge. Chemicals from non-point agricultural sources are also a concern for their affect on Refuge wetlands.

3.2.6 Geomorphology and Soils

3.2.6.1 Geomorphology

The Refuge lies in a area that has been shaped by glaciers, water, and wind. The area has been studied and described by the Geological Survey and Resource Assessment Division of the Missouri Department of Natural Resources.

During the last period of glaciation, called the Wisconsin glaciation, the exposed rocks of northern Missouri, eroded by earlier glacial advances, were scoured again by advancing ice sheets. The result of glacial scouring is a combination of pre-glacial and postglacial eroded surfaces.

Glacial till or drift, composed of sand, clay, silt, gravel, cobbles, and boulders, deposited on the surface and in valleys that were eroded earlier, can be quite thick, up to several hundred feet. These glaciated plains and glacial till are constantly being eroded by rainfall and dissected by runoff, gradually destroying the formerly nearly level topography. The drainage pattern consists of nearly parallel streams trending north-south toward the Missouri River, the major drainage stream.

In the glaciated area, particularly near the Missouri River, post-glacial winds carried large quantities of fine silt into the air, subsequently depositing it in the “river hills.” These deposits are a noticeable characteristic of the landscape along I-29 from Kansas City to Iowa. The silty material, deposited in wind-blown drifts (like sand dunes, but finer-grained), is called loess. Because of the way the silt particles were wind-deposited, the particles are “stacked” vertically, and when these deposits must be excavated, as in road-building, the road cuts are typically vertical, rather than sloped, to reduce erosion by storm water runoff. (Water Resources Report Number 61)

3.2.6.2 Soils

The soils of the Refuge fall into three major associations. The slope, depth, drainage, and other characteristics of the soils can differ within an association. The association gives a general idea of soil characteristics. More detailed soil descriptions are needed to evaluate the suitability of a site for specific projects such as building or road construction.

The west and central portion of the Refuge occupies the Luton-Wabash-Blencoe Association. This association is characterized as nearly level, poorly drained and somewhat poorly drained, clayey soils that formed in alluvium; on high flood plains along the Missouri River. The area of the Refuge between the previous association and the hills occupies the Motark-Dupo-Dockery Association, which is nearly level, moderately well drained and somewhat poorly drained, silty soils that formed in alluvium; on flood plains. The soils in this association are on flood plains along secondary streams that cross the Missouri River flood plain. The eastern portion of the Refuge occupies the Timula-Monona-Napier Association. This association is characterized as very gently sloping to steep, well drained, silty soils that formed in loess and slope alluvium; on uplands and foot slopes. The soils in this association are on very dissected, narrow, branching ridgetops, on steep gullied side slopes, and on the lower foot slopes adjacent to the Missouri River flood plain. (USDA, NRCS)

3.3 Wildlife

3.3.1 Migratory Bird Species

The Refuge bird list contains 268 species that have been recorded on the Refuge. Another 33 birds, listed under “Accidental” birds, have been reported but are not normally expected to be present.

Waterfowl are the most prominent and economically important group of migratory birds using the Refuge. Non-consumptive use of bird resources also is important on the Refuge. Birdwatching on the Refuge accounted for approximately 25 percent of public-use days in 2001.

3.3.2 Fish Species

The Refuge lies within the floodplain of the Missouri River. Temporary wetlands do not typically hold enough water to support fisheries, and species found at Squaw Creek NWR come mostly from Davis Creek and Squaw Creek. There are at least 10 species of fish present on the Refuge. About three species are common or abundant in certain pools or reaches. Carp, gar and bullhead are the most common species. Although the Refuge still hosts most of the species that were present historically, the relative abundance and distribution of some species has changed dramatically in the last 100 years. Some of these changes are attributable to events such as the introduction of the common carp, reduction in overall wetland abundance, and sedimentation.

Species found on the Refuge include: shortnose gar, common carp, smallmouth buffalo, largemouth buffalo, river carpsucker, channel catfish, black bullhead, largemouth bass, white crappie, and green sunfish.

3.3.3 Freshwater Mussels

Four species of freshwater mussels have been recorded on the Refuge: Yellow sandshell (Davis and Squaw creeks); Giant floater (Davis and Squaw creeks); Pondhorn (Davis and Squaw creeks); and Fingernail Clam, which are present in wetlands. Freshwater mussels are typically found buried in the substrate in beds containing several different species with similar habitat requirements. Most of these species require flowing water and coarse gravelly substrates, although some survive well in silty, lake-like conditions in backwaters. Water and sediment quality are important habitat criteria for mussels.

3.3.4 Mammals

Squaw Creek NWR is home to many resident mammal species including white-tailed deer, red fox, grey fox, fox squirrels, grey squirrels, cotton-tail rabbits, bobcats, coyotes, raccoons, striped skunks, muskrats, badgers, river otter, opossum, mink and beavers. Small mammals present on the Refuge also include short-tailed shrew, least shrew, Eastern mole, woodchuck, Plains pocket gopher, Western harvest mouse, deer mouse, white-footed mouse, house mouse, meadow jumping mouse, long-tailed weasel, and hispid cotton rat. A total of 34 mammals have been observed on the Refuge since 1935 by Refuge personnel and visiting mammalogists. An additional 13 mammals have been documented as occurring in nearby counties.

Bats found on the Refuge include the little brown bat, big brown bat, and hoary bat.

3.3.5 Upland Game Birds

Four species of upland game birds - Bobwhite Quail, Ring-necked Pheasant, Wild Turkey and Mourning Dove - reside on Refuge lands.

3.3.6 Amphibians and Reptiles

Thirty-five species of amphibians and reptiles are known to use the Refuge. Species regularly seen are snapping turtles, painted turtles, box turtles, fox snakes, water snakes and various garter snakes.

Species found on the Refuge include: tiger salamander, small-mouthed salamander, Plains spadefoot, Eastern American toad, Great Plains toad, Woodhouse's toad, Blanchard's cricket frog, Cope's grey treefrog, Western chorus frog, Plains leopard frog, bullfrog, Blanding's turtle (state-listed endangered species), ornate box turtle, red-eared slider, Eastern spiny softshell turtle, five-lined skink, six-lined racerunner, Eastern yellow-bellied racer, prairie ring-necked snake, black snake, Western fox snake, prairie kingsnake, red milk snake, diamond-backed water snake, northern water snake, bullsnake, Graham's crayfish snake, Texas brown snake, Western ribbon snake, Western Plains garter snake, red-sided garter snake, Eastern Massasauga rattlesnake.

3.3.7 Federally Listed Threatened and Endangered Species

3.3.7.1 Mammals

No Federally listed endangered or threatened mammal species occur on the Refuge, however the Indiana bat has been recorded in adjoining counties.

3.3.7.2 Birds

Federally listed threatened and endangered species sighted in the recent past have included the Peregrine Falcon, Piping Plover, Least Tern and Bald Eagle.

The interior Least Tern was federally listed as endangered in May 1985. The interior population of the Least Tern (*Sterna antillarum athalassos*) currently nests in the Mississippi and Rio Grande River basins from Montana south to Texas, and from eastern New Mexico and Colorado to Indiana and Louisiana. Loss of sandbar habitat due to dams, river channelization, and water level changes has caused a decline in interior Least Tern populations. Undisturbed sandbars are critical for successful Least Tern nesting. Predation, flooding and recreational activities on sandbars can cause nest disturbance and abandonment.

The Piping Plover (*Chadarius melodus*) (Great Plains Population) is rarely seen on Squaw Creek NWR. Piping Plovers nest in coastal areas, but they are also prairie birds, nesting across the Great Plains of the United States and Canada, but in perilously low numbers. The Great Plains population is listed as threatened. The loss of prairie wetland areas contributes to their decline. Like many shorebirds, Piping Plovers feed on immature and adult insects and other invertebrates at the water's edge. They winter primarily along beaches, sandflats, and algal flats on the Gulf of Mexico.

The formerly listed Peregrine Falcon uses the Refuge, as well.

The Bald Eagle, a federally listed threatened species, nests in three sites on the Refuge. From mid-November into January, 250 to 400 Bald Eagles commonly gather at the Refuge, preying upon weak and dying waterfowl and roosting in the large cottonwood trees. This is one of the largest wintering eagle concentrations in the lower 48 states.

3.3.7.3 Reptiles

A number of Missouri state-listed endangered and threatened species are found on the Refuge, including the Eastern Massasauga rattlesnake, Blanding's turtle and Western fox snake. Squaw Creek NWR is most likely the home of the last viable breeding population of the Eastern Massasauga rattlesnake, which is also a candidate species for federal listing.

Candidate species are plants and animals for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act (ESA), but for which development of a listing regulation is precluded by other higher priority listing activities.

The Candidate Conservation Program provides a means for conserving these species. Early conservation preserves management options, minimizes the cost of recovery, and reduces the potential for restrictive land use policies in the future. Effective candidate conservation may reverse the species' decline, ultimately eliminating the need for ESA protection.

Candidate species receive no statutory protection under the ESA. However, the Service encourages the formation of partnerships to conserve these species because they are by definition species that may warrant future protection under the ESA.

3.3.7.4 Plants

No Federally endangered or threatened plant species occur on the Refuge.

3.4 Public Use

The 1997 Refuge System Improvement Act gives priority to six wildlife-dependent recreational uses of national wildlife refuges when these uses are compatible with the purposes for which the refuge was established. These uses include hunting, fishing, wildlife photography, wildlife observation, environmental education and interpretation.

The Refuge is open daily during daylight hours. There is no entrance fee. The Refuge headquarters/visitor contact station is open on weekdays, except national holidays. Open-house weekends for public visitation are held during spring and autumn migration periods. Volunteers, who staff the visitor contact station, provide information and conduct sales of educational materials.

Visitor activities include birdwatching, photography, hiking, viewing interpretive exhibits in the visitor contact station, environmental education programs for teachers and student groups, and driving the 10-mile Wild Goose Interpretive Auto Tour Loop (but periods of rain can make Refuge roads impassable). Visitors fish on the Refuge. In the fall visitors pursue white-tailed deer as part of the Refuge's managed hunt. Camping is not permitted on the Refuge. Campground facilities are available at nearby Big Lake State Park.

A wheelchair-accessible observation tower overlooking the 900-acre Eagle Pool provides an excellent opportunity for wildlife watching and photography. Hiking opportunities include the wheelchair-accessible half-mile Mike Callow Memorial Trail from Refuge headquarters to the base of the Loess Bluff grasslands; the 0.5-mile Loess Bluff Interpretive Trail near headquarters; and the 1.5-mile Eagle Pool Trail between Eagle and Pelican pools. In early December, the Refuge and the Missouri Department of Conservation co-sponsor "Squaw Creek Eagle Days" the first full weekend in December. This weekend event features special educational programs, displays, and eagle-viewing opportunities.

The Refuge, located in a rural region, is within 30 miles of a St. Joseph, Missouri, and within 100 miles of Kansas City, Missouri. The population of the two urban areas exceeds half a million people. With a new addition to the Refuge office and visitor center, the potential exists for the Refuge to play a greater role as an educational resource and wildlife observation destination.

3.5 Socioeconomics

The National Environmental Policy Act (NEPA) of 1969 requires agencies to disclose to decision makers and to the public what society gains or loses with projects that have the potential of altering the environment. In addition, Executive Order 12898 requires agencies within the Department of Interior to evaluate whether any notable impacts to minority and low-income populations and communities will occur with the proposed project action.

Based upon 2000 census data (or as indicated), Holt County can be characterized by the following statistics:

- Population 5,268 (2001 data); a reduction of 1.6 percent from 2000 data
- 99.1 percent are white with the balance other races
- Median age 41.8
- 26.2 percent 19 years old or younger
- 24.2 percent 62 years old or older
- 81.9 percent of persons over 25 years old are high school graduates
- 11.7 percent of persons over 25 years old have a bachelors degree or higher
- 23 minutes mean travel time to work for workers over 16 years old
- Farmland (1997) 231,040 acres (78 percent of county area)
- Personal income per capita (1999) \$15,876
- Median household income (1999) \$29,461

Agricultural land dominates Holt County, representing 78 percent of land. In 2002, 105,700 acres of soybeans and 94,900 acres of corn were planted in the county (Missouri Agricultural Statistics Service). Other prevalent land use includes grassland and deciduous upland mixed oak forest.

The Service produced “Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation.” This 1997 report, which was updated in 2002, is the first of a multi-phase study investigating the impact of national wildlife refuges on their local economies. It is a broad spectrum report that discusses the income and employment effects that recreational visitors to refuges have on the economies of local regions. In addition to the economic effects of refuge hunting and fishing programs in local communities, it measures the economic impact of eco-tourism, the relatively recent phenomenon of large numbers of people traveling substantial distances to take part in non-consumptive uses of the natural environment. Eco-tourism is one way to derive economic benefits from the conservation of wildlife and habitat.

The study found that recreational visits to national wildlife refuges generate substantial economic activity. In fiscal year 2002, people visited refuges more than 35.5 million times for recreation and environmental education. Their spending generated \$809.2 million of sales in regional economies. As this spending flowed through the economy, more than 19,000 people were employed and \$315.2 million in employment income was generated.

3.6 Archeological and Cultural Values

Holt County contains a site with possible evidence of the Early Man period (prior to 12,000 B.C.), the Grundel Mastodon site 25-HO-11. The earliest commonly accepted cultural period in Missouri is the Paleo Indian (and Dalton), 12,000-7,000 B.C.; no sites of this culture have been reported in Holt County but sites often are found along the Mississippi and Missouri rivers and could be deeply

buried in the Refuge area; a private collector has a Dalton-type point reportedly from the Derr tract on the Refuge. For the Archaic culture, 7000-1000 B.C., sites have been reported in Holt County but not within the Refuge; but again, the private collector has material reportedly from the Derr tract. The Altithermal, a significantly warm period, peaked just prior to 2000 B.C., resulting in Archaic cultural changes. The Woodland culture, 1,000 B.C.-A.D. 900, is represented by numerous sites in Holt County and a few within the Refuge. People during this period developed pottery and the bow-and-arrow, buried their dead in mounds, and commenced gardening. No late prehistoric (e.g., Oneota) sites have been reported in Holt County.

In the early historic period the Sac and Fox tribes claimed territory that includes the Refuge. The Missouri and Oto tribes migrated into Missouri around 1673, but apparently did not stay long. By the early 19th century the Kansa tribe occupied the Refuge area. The Kickapoo and Delaware may have been in the Refuge area, too. The Refuge area is in the Royce Cession 151, a common hunting area for tribes created as a result of the Treaty of Prairie du Chien in 1830. But in 1833 the U.S. Government settled the Potawatomi in this area until it became state property in 1837. No Indian sites from this period have been reported in Holt County.

The cultural history of Service properties within the Squaw Creek Management District (e.g., Worth County), appears to be much the same as for the Refuge, except no sites have been identified on any of these properties.

The Refuge benefited from the 1930s New Deal federal employment efforts. A Civilian Conservation Corps (CCC) camp was located 5 miles north of the Refuge in Mound City. Corpsmen constructed a number of facilities, including the Loess Bluff hiking trail, using flagstone rock for the steps, a shelter at the top of the bluff trail, the south dam and water control structure, the flagstone rock wall around the present parking lot, an equipment building and a major portion of the auto tour route. In 1940 and 1941, men from the Works Progress Administration (WPA) constructed the rest of the building, including a horse barn, a chicken coop, shop, fur house, corn crib, headquarters building, garage, grain shed, dragline shed, and pump house.

Cultural resources investigations have covered approximately 550 acres of the Refuge and 35 acres of management district land. These studies and other sources have identified 12 sites, including the headquarters complex, on the Refuge. Sites within the pools can be anticipated but would be deeply buried. Sites on the adjacent uplands, based on the survey of the Derr tract, are likely numerous and shallow.

No National Register properties are located on the Refuge or the management district. As of April 1, 2003, four properties are listed in Holt County, none being indicative of what might be found on the Refuge. Andrew County contains three, Daviess County contains three, Gentry County contains three, Mercer County contains two, and Worth County contains one National Register property.

The following listed Indian tribes have been recognized by the Federal government or self-identified by the tribe as having a potential concern for traditional cultural resources, sacred sites, and cultural hunting and gathering areas in the counties in which the Refuge and management district are located.

Andrew, Holt, and Worth counties:

- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma
- Omaha Tribe of Nebraska
- Otoe-Missouria Tribe of Indians

- Sac & Fox Nation of Missouri in Kansas and Nebraska
- Sac & Fox Nation of Oklahoma
- Sac & Fox Tribe of the Mississippi in Iowa

Daviess and Mercer counties:

- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma

Gentry County: None

Although Indian tribes are generally considered to have concerns about traditional cultural properties, other groups such as church congregations, civic groups, and county historical societies could identify similar concerns.

The Refuge archeological collections contain prehistoric artifacts currently not associated with any modern tribe. The collections contain no human remains and no recognized funerary objects, sacred objects or objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act. Although sites of historic period Indian occupation have not been identified on the Refuge, they could be located and could contain cultural items.

The Refuge has museum collections that are managed under a Region-wide Scope of Collection Statement (10-31-94). To date, one archeological investigation has produced 94 artifacts from Refuge lands; artifacts are stored at the University of Missouri, Columbia, under a cooperative agreement. Artifacts are owned by the Federal Government and can be recalled by the Service at any time. And the Refuge has an on-site collection of 83 zoological specimens.

Cultural resources are important parts of the Nation's heritage. The Service is committed to protecting valuable evidence of human interactions with each other and the landscape. Protection is accomplished in conjunction with the Service's mandate to conserve fish, wildlife, and plant resources.

Chapter 4: Environmental Consequences

4.1 Effects Common to All Alternatives

4.1.1 Environmental Justice

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Bill Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

None of the proposed management alternatives disproportionately place an adverse environmental, economic, social, or health impacts on minority or low-income populations.

4.1.2 Archaeological and Cultural Values

The activities that are most positive for cultural resources are those that reduce or eliminate activities on the Refuge. In general, recreation activities and invasive species control have little potential to affect cultural resources and are envisioned as having a neutral effect on cultural resources. However, non motorized use of trails may have a negative impact on cultural resources by increasing visitor traffic to sensitive cultural areas. Cultural resources are sensitive to ground disturbing activities. Activities that may have a negative impact on cultural resources include farming, dredging, and construction of new trails or facilities. Fire suppression activities can also damage archaeological sites if new roads and firelines are constructed while combating the fire.

The impacts of the alternatives on cultural resources were evaluated with the assumption that significant, but as yet unidentified, cultural resources may occur on the Refuge. Under any alternative, site specific actions such as construction of facilities will be subject to additional environmental review in accordance with the National Environmental Policy Act, which affords protection to significant cultural resources as prescribed by the National Historic Preservation Act and other applicable regulations and guidelines. Although avoidance is the preferred approach, mitigation of effect is an acceptable treatment and development activities may, therefore, result in a net loss of resources.

4.1.3 Climate Change Impacts

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies under its direction that have land management responsibilities to consider potential climate change impacts as part of long range planning endeavors.

The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's "Carbon Sequestration Research and Development" (U.S. DOE, 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts (grasslands, forests, wetlands, tundra, perpetual ice and desert) are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. The Department of Energy report's conclusions noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Preserving natural habitat for wildlife is the heart of any long range plan for national wildlife refuges. The actions proposed under any of the alternatives would conserve or restore land and water, and would thus enhance carbon sequestration. This in turn contributes positively to efforts to mitigate human-induced global climate changes.

4.1.4 Prescribed Fire as a Management Tool

The Refuge's Fire Management Plan (FMP) provides additional detail beyond what is captured in this section and will be adopted through this EA.

4.1.4.1 Social Implications

Prescribed burns will have an effect on the local public. Public concern is noticed every time a fire is set. A prescribed burn will effect and benefit the local community in many ways. These benefits must be explained to the public at every opportunity.

A prescribed burn on the Refuge will be a direct benefit to the public in creating recreational opportunities through increased wildlife populations for hunting and observation. If a wildfire is started on or near the Refuge, the areas that were previously prescribed burned and the firebreaks intended for prescribed burning will be of extreme benefit in controlling the fire.

The aspect of the fire that will solicit the most public concern will be the smoke. Smoke from a Refuge fire could impair visibility on roads and become a hazard. Actions to manage smoke include: use of road guards and

car, signing, altering ignition techniques and sequence, halting ignition, suppressing the fire, and use of local law enforcement as traffic control. Burning will be done only on days that the smoke will not be blown across the community or when the wind is sufficient as not to cause heavy concentrations.

If Missouri institutes smoke regulations, the FMP will be amended to ensure consistency with those regulations. Combustion of fuels during prescribed fire operations may temporarily impact air quality, but the impacts are mitigated by small burn unit size, the direction of winds the burns are conducted with, and the distance from population centers. All efforts will be taken to assure that smoke does not impact smoke sensitive areas such as roads and local residences. In the event of wind direction changes, mitigative measures will be taken to assure the public safety and comfort.

Refuge staff will work with neighboring agencies and in consultation with State air quality personnel to address smoke issues that require additional mitigation.

The fire prescription portion of the Annual Prescribed Fire Plan for each unit proposed to be burned during the burning season will have specific mitigative measures to deal with unexpected smoke management problems. This will include identified problems that unforecasted wind changes may cause and measures to be employed to protect the public.

Public concern may arise with any kind of smoke from the Refuge. This concern can be relieved only by a concerted effort by Refuge personnel to carefully inform the local citizens about the prescribed burning program. Emphasis will be placed on the benefits to wildlife as well as the safety precautions in effect. Formal interpretive programs both on and off the Refuge, explaining the prescribed burning program, will be encouraged.

4.1.4.2 Archaeological and Cultural Values

There may be archaeological sites within prescribed burn units. When these units are burned, it is doubtful that the fire will have any adverse impact on the sites. The fire will be only a temporary disturbance to the vegetation in the area and in no way destroy or reduce the archeological value. All artifacts are buried well beneath the surface. No above ground evidence exists. No known sites will be impacted by prescribed burning operations.

4.1.4.3 Flora

The prescribed burning program will have a visible impact on vegetation and the land. Immediately after a fire much of the land will be blackened. There will be no grasses or ground forbs remaining and most of the higher brush such as oak sprouts and willow will be bare of leaves. Trees will be scorched up to 20 feet above the ground. This will be particularly noticeable on the light colored bark of aspen and birch. There may be large areas up to 1 acre in size interspersed throughout the burn that are untouched by the fire. This may be a result of wet ground conditions or a break in fuel continuity.

Within 3 days after the burn, the grasses and forbs will begin to grow. The enriched soil will promote rapid growth such that after 2 or 3 weeks the ground will be completely covered. The willow and oak will, in many cases, re-sprout. The bases of the trees as well as the burned slash and stumps will be partially or completely covered by the new growth. Some of the less fire resistant trees will show signs of wilting and may succumb within a month or two. Generally, after one season any sign of the prescribed burn will be difficult to detect without close examination. After 2 or 3 years it will be virtually impossible to detect the presence of the fire.

Other more long lived signs will remain for an indefinite period of time. The firebreaks will not be allowed to grow over in order to realize their benefit during wildfires and future prescribed burns. Vehicle tracks through the burn are visible on the freshly burned ash and may be longer lived if the vehicle became stuck or created tire grooves in the ground. Travel across the burn area will be kept to a minimum. Vehicle travel may be necessary in some instances, such as lighting the fire lines or quickly getting water to an escape point. A fire plow will be used only in the event that a break-over does occur and cannot be controlled by any other method. The deep trench of the plow would leave a very long lived scar. This trench could be repaired by filling, which would eliminate it from view after 5 to 10 years.

4.1.4.4 Listed Species

The potential impacts of fire on listed species is likely to be positive, if there is any impact. Of the federally listed threatened and endangered species on or near the Refuge, three are birds (Bald Eagle, Piping Plover, and Interior Least Tern). Bald Eagles that roost, nest, and feed on the Refuge, if affected at all by burning, will only be so temporarily by smoke or human activity.

Nesting trees will be protected and burning will not be conducted at a time or in a way to negatively impact any nesting eagles.

The Interior Least Tern favors sandbar habitat for nesting. This generally is not habitat that will be burned. If a burn were to be conducted to clear vegetation on a sandbar to benefit the Terns, it would be done at a time of the year that would not conflict with the Tern use of the area.

Squaw Creek NWR is within the historical range of the Massasauga rattlesnake. The Massasauga is a candidate species for listing. During a prescribed burn in 2001, Refuge staff discovered the snake in an area not previously believed to harbor the species. Eight snakes were killed in that burn, and since then we have continued snake research in an effort to avoid conducting spring burns in areas where there are snakes. While it is positive that the Eastern Massasauga rattlesnake appears to be thriving on the Refuge, populations expanding into new areas pose a problem for spring burns. The Refuge's prescribed burning program has been modified to account for any potential problems. Modifications include burning early in the spring, prior to the snakes emerging from their underground hibernation areas, as well as burning later in the fall after the snakes have gone back into hibernation.

We are conducting a Section 7 review concurrent with the review of the draft CCP. The Section 7 review will examine the modified prescribed burning program.

Missouri is the southern edge of the Northern Great Plains population of Piping Plover. In this area, Plovers make their nests on beaches, sand bars, and dredged material islands of major river systems. The Northern Great Plains birds are federally listed as threatened, and with approximately 1,398 breeding pairs it is the largest population of Piping Plovers in the United States. Beaches, sandbars and islands are not typically locations where prescribed burns are conducted. If a burn were to be conducted in this kind of habitat, it would be scheduled so that conflict with the Plovers would be avoided.

4.1.4.5 Soils

The effect of fire on the soil depends largely on the fire intensity and duration. On areas with high fuel loads, a slow backing fire is usually required for containment and desirable results. The intense heats generated by this type of fire will have a greater effect on the soils than fast, cool head-fires used on farm fields and wildlife openings. The cool, moist soils of wetter areas in the burn units or areas with little fuel will be unaffected by the fire.

The severity of damage to the soil depends to a great degree on the thickness and composition of the organic mantle. In cases where only the top layer of the mantle is scorched or burned, no damage will result to the soil below. This is usually the case in forested areas.

In open areas such as dry grassland or wet meadow sites, the blackening of the relatively thin mantle will cause greater heat absorption and retention from the sun. This will encourage earlier germination during the spring growing season. Nutrient release occurs as a result of the normal decomposition process. Fire on the soil will greatly speed up the process. The rate and amount of nutrients released will be dependent on the fire duration and intensity as well as the amount of humus, duff and other organic materials present in the mantle. The increase, immediately after a burn, of calcium, potash, phosphoric acid and other minerals will give the residual and emergent vegetation a short-term boost. However, the rapid leaching through the sandy soils will cause rapid runoff of these nutrients and only short-term benefits. The increased nutrification of the soil by the emergent vegetation and increased nutrient release result in rapid regrowth of grasses and other succulent vegetation on the sites.

There is no evidence to show that the direct heating of the soil by the burning of material above it with a fire of low intensity has any significant adverse effect. Fire of this type has little total effect on the soils and, in most cases, would be beneficial.

4.1.4.6 Escaped Fire

With any prescribed fire there always exists the possibility of its escape into the surrounding area. This can be caused by one or more factors that may or may not be preventable. Inadequate firebreaks, too few personnel, unpredicted changes in weather conditions, peculiar fuel type, being in too big a hurry, and insufficient knowledge of fire behavior are a few factors which could cause loss of control. An escaped fire could turn into a very serious situation. The damage that could result would be much less severe on the Refuge than if it encroached on private land where buildings, equipment, and land improvements would be involved. Many of the prescribed burn areas are well within the Refuge and of minimal threat to private or other improved lands in the event of an escape. Extreme care, careful planning, and adherence to the unit prescription will be exercised when prescribed burning all units, particularly when burning areas that are near or adjacent to the Refuge boundary.

In the event that a prescribed fire does jump a firebreak and burn into unplanned areas, there is a high probability of rapid control with minimal adverse impact. The network of firebreaks and roads will greatly assist in rapid containment. In most cases all of the Refuge fire fighting equipment will be immediately available at the scene with all nearby water sources previously located. The applicable DNR fire suppression crews and local fire departments will always be notified of a prescribed burn. Thus, maximum numbers of experienced personnel and equipment are immediately available for wildfire suppression activities.

4.1.5 Trapping

Trapping is occasionally used as a management tool under permit or by Refuge staff. Removing beaver that are plugging water control structures or muskrats, beaver, or woodchucks that are damaging dikes by undermining them with tunnels are examples of management uses for trapping. The direct impact upon the animal trapped is fatal, but impacts on the overall population of the species in the area is negligible due to the small number of animals taken and the restricted areas trapped.

4.1.6 Snow Goose Management

All five alternatives propose to assist in international efforts to reduce the mid-continent population of Snow Geese by 5 percent each year. While this action would result in higher Snow Goose mortality in the short-term, this course is likely to improve the species as a whole. The mid-continent population is experiencing a “perilous abundance” and numbers are beyond the carrying capacity of the nesting grounds in Canada. Reducing the Snow Goose population is essential to the long-term health of the population.

Reducing the population may result in less spectacular viewing opportunities for visitors at the Refuge. However, we believe that the need to prevent further nesting habitat loss overrides this concern.

4.1.7 Squaw Creek Wildlife Management District

All five alternatives would benefit migratory game birds and non-game birds as well as resident species by developing, improving and maintaining native riparian, wetland, and grassland habitats consistent with the existing dominant non-agricultural structure. Soil and water conservation would benefit by converting land to a natural state.

4.2 Alternative A: Current Management Practices (No Action)

Under this alternative there would be no major change in Refuge goals, objectives, and strategies.

4.2.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massasauga rattlesnake would benefit somewhat because the Refuge would maintain existing wet prairie (1,077 acres) habitat. Piping Plovers and Least Terns, both of which use sandbars and beaches for nesting, would benefit less under this alternative because it does nothing to alleviate sedimentation, which is filling in these habitats. Some species would benefit if the Refuge is successful in gaining regional shorebird designation as more attention is given to shorebird species. While studies monitoring the Blanding's turtle would continue, habitat would continue to degrade as marshes filled with silt.

4.2.2 Wildlife and Habitat Resource Management

Alternative A would not drastically change wildlife and resource habitat management (see Table 3). Wetland, wet prairie, grassland and bottomland forest habitat acreages would change only slightly as the Refuge continued its current management trend toward less cropland. Current efforts to restore Loess Hill habitat would continue. All habitats would benefit from continued efforts to control invasive, exotic and nuisance species. Less habitat would be restored than under alternatives B, D, and E because only minor land acquisition would occur. All Refuge habitats would benefit from the Refuge working with private landowners on watershed improvements to reduce sedimentation caused by soil erosion. Wet prairie would be maintained at its current acreage; three of the four other alternatives would increase the amount of wet prairie on the Refuge.

Continuing current management would benefit wildlife species using the Refuge. Efforts to reduce sedimentation, manage bottomland uplands for waterfowl, work with others to reduce the Snow Goose population, and reduce the size of the deer herd on the Refuge will all improve the carrying capacity of Refuge habitat. Grassland birds and upland game birds would benefit from current grassland management, but not as much as under alternatives D and E, which provide somewhat more habitat.

4.2.3 Sedimentation and Water Quality

The Refuge would benefit from work with private landowners within the watershed to implement conservation practices that would reduce erosion and the resulting sedimentation.

4.2.4 Public Use and Education

Under Alternative A (as well as alternatives B and E), public use and education efforts would see modest improvement. Completion of the visitor center will likely attract some additional users and open some new opportunities to convey refuge messages. Interactive programs and facilities would be developed with a goal of accommodating 130,000 visitors a year. Refuge staff would maintain environmental education programs at 2003 levels, and wildlife observation facilities and programs would be improved to encourage greater participation and more interaction with visitors. Opportunities to hunt white-tailed deer would be increased as part of the effort to reduce the Refuge deer herd. Public use efforts would not seek to reach out to nontraditional Refuge users. Community awareness of the Refuge and Refuge goals might increase as greater focus is placed on involving volunteers and the Refuge's relationship with Friends of the Squaw Creek NWR.

Table 2: Landcover Acreages for Alternatives A, B, C, D and E

Habitat Description	Alternative A Current Management (No Action)	Alternative B Restore Historic Wet and Mesic Prairie	Alternative C Enhance Public Use with Current Resource Management Level	Alternative D Optimize Resource Management with Enhanced Public Use Level (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
<i>Agricultural Field</i>					
Agricultural Field	579	0	579	300	300
<i>Bottomland Forest</i>					
Alluvial Bottom-land Hardwoods	865	865	865	865	865
Semi-permanently Flooded Alluvial Bottom-land Hardwoods	112	112	112	112	112
Tree Row	23	23	23	23	23
<i>Subtotal</i>	1,000	1,000	1,000	1,000	1,000
<i>Bottomland Mesic Prairie</i>					
Bottomland Mesic Prairie	291	870	291	508	570
<i>Developed Land</i>					
Administrative Area	9	9	9	9	9
Channelized Drainage Ditch	135	135	135	135	135
Major Roads and Adjacent Right-of-ways	108	108	108	108	108
<i>Subtotal</i>	251	251	251	251	251
<i>Loess Hill Forest</i>					
Loess Hill Mixed Hardwood Upland Forest	366	366	366	366	366
Mixed Lowland Hardwood Forest	8	8	8	8	8
Tree Row	4	4	4	4	4
<i>Subtotal</i>	378	378	378	378	378
<i>Loess Hill Prairie</i>					
Eastern Gamma Grass Seed Prairie	75	75	75	75	75
Loess Hill Prairie	147	147	147	268	147
<i>Subtotal</i>	221	221	221	299	221

Table 2: Landcover Acreages for Alternatives A, B, C, D and E (Continued)

Habitat Description	Alternative A Current Management (No Action)	Alternative B Restore Historic Wet and Mesic Prairie	Alternative C Enhance Public Use with Current Resource Management Level	Alternative D Optimize Resource Management with Enhanced Public Use Level (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
<i>Managed Wetland</i>					
Permanently Flooded Non- emergent Wet- land	878	878	878	878	878
Seasonally Flooded Emer- gent Marsh	2,531	349	2,531	2,531	2,531
<i>Subtotal</i>	3,403	1,227	3,403	3,452	3,403
<i>Old Field</i>					
Old Field	59	59	59	0	59
<i>Wet Prairie</i>					
Wet Prairie	1,077	3,259	1,077	1,077	1,077
<i>Wetland</i>					
Bulrush/Reed Canary Grass Wetland	148	148	148	148	148
Reed Canary Grass/Willow Wetland	24	24	24	24	24
Seasonally Flooded Emer- gent Marsh	5	5	5	5	5
<i>Subtotal</i>	176	176	176	176	176

4.3 Alternative B: Restore Historic Wet and Mesic Prairie

4.3.1 Listed and Other Species of Interest

Same as Alternative A, except that an increase in wet prairie habitat from 1,077 acres to 3,259 acres would likely benefit Eastern Massassauga rattlesnakes on the Refuge. Under Alternative B, more emphasis would be placed on monitoring the snakes to determine how they respond to habitat manipulation.

4.3.2 Wildlife and Habitat Resource Management

Under this alternative, 579 acres of cropland would be converted to grasslands or wet prairie, potentially benefitting waterfowl and grassland bird species. While waterfowl would lose cropland forage, converting it to natural vegetation would improve nesting habitat and provide more natural foods. This alternative, with its elimination of cropland, would have the most drastic effect of any alternative on the redistribution and dispersion of the large flocks of Snow Geese. More wet prairie would be conserved under this alternative than Alternative B, which would result in more habitat suitable to the eastern Massassauga rattlesnake.

We used a modeling process developed by USGS scientists (Rohweder et al. 2002) to examine the relative effects of different alternatives on selected wildlife that use the Refuge. For each species of interest, habitat potential for each land cover type was given a rank of 0, 1, 2 or 3 (no, low, medium, and high potential, respectively). The acreage of each habitat times its value to that species or group of species was summed and divided by the entire refuge acreage ($PSO = [(habitat\ potential\ Habitat\ A * acres\ of\ Habitat\ A) + (habitat\ potential\ Habitat\ B * acres\ of\ Habitat\ B) + \dots + (habitat\ potential\ Habitat\ Z * acres\ of\ Habitat\ Z)] / total\ refuge\ acreage$). This resulted in a weighted average Potential Species Occurrence (PSO) score for each species or group of species for each alternative. For example, if the entire Refuge were high potential habitat for a given species, it would receive a PSO score of 3.0 (i.e. $3 * total\ refuge\ acreage / total\ refuge\ acreage$). If half of the Refuge were medium potential habitat for a given species, and half were low, it would receive a PSO score of 1.5. Habitat potential ranks were based on the integrated life cycle needs of each species as determined by FWS biologists. The land cover is based upon color infrared aerial photos taken in August, 2001 and classified by the Refuge biologist. The cover type data were manipulated using Geographic Information System (GIS) to develop the land cover alternatives.

In order to assess the broad impacts of the Comprehensive Conservation Plan, 30 bird and one reptile species were chosen to represent several important habitat types found on the Refuge (Table 4). We selected the species because they are Region 3 conservation priority species (USFWS 2002) that use the major habitat types on the Refuge. Potential Species Occurrence scores were calculated for Bald Eagle (threatened), Eastern Massassauga rattle snake, and six groups of species (six forest birds, six grassland birds, two secretive marsh birds, eight shorebirds, two wet prairie birds, and five species of waterfowl).

There was little difference under the various alternatives in Potential Species Occurrence scores for any one species or group of species except in Alternative B. Under that alternative, acreages were converted from cropland and wetland to prairie, with a slight increase in forest as well. That change in habitats benefits the Massassauga rattle snake, grassland birds, and forest birds. In response to this change in habitats under Alternative B, the PSO scores for the Bald Eagle, waterfowl, and secretive marsh birds declined.

Table 3: Weighted Average Species Occurrence for Selected Species Groups

Species Group	Number of Species	Alternative A (No Action) Average	Alternative B Restore Historic Wetland Mesic Prairie	Alternative C Enhance Public Use with Current Resource Management.	Alternative D Optimize Resource Management. with Enhanced Public Use Level (Preferred Alt.)	Alternative E Intensive Wetland Management. with Extreme Measures to Combat Sedimentation
Forest Neotropical Migrants ¹	6	0.38	0.46	0.38	0.39	0.39
Forest Raptor ²	1	1.36	0.77	1.36	1.36	1.36
Grassland Birds ³	6	0.32	0.82	0.32	0.40	0.39
Secretive Marsh Birds ⁴	2	1.49	0.79	1.49	1.50	1.50
Shorebirds ⁵	8	1.07	0.52	1.07	1.07	1.07
Waterfowl ⁶	5	1.47	0.67	1.47	1.48	1.48
Wet Prairie Birds ⁷	2	0.47	0.51	0.47	0.48	0.49
Wet Prairie Reptile ⁸	1	0.92	1.66	0.92	0.99	0.99

1. *Black-billed Cuckoo*; *Whip-poor-Will*; *Redheaded Woodpecker*; *Northern Flicker*; *Wood Thrush*; *Orchard Oriole*

2. *Bald Eagle*

3. *Loggerhead Shrike*; *Field Sparrow*; *Grasshopper Sparrow*; *Dickcissel*; *Bobolink*; *Eastern Meadowlark*

4. *Black-crowned Night Heron*; *Common Moorhen*

5. *Piping Plover*; *Greater Yellowlegs*; *Hudsonian Godwit*; *Marbled Godwit*; *Stilt Sandpiper*; *Buff-breasted Sandpiper*; *Short-billed Dowitcher*; *Wilson's Phalarope*

6. *Snow Goose*; *Canada Goose (resident)*; *Canada Goose (migrant)*

7. *Northern Harrier*; *Long-eared Owl*

8. *Eastern Massasauga rattlesnake*

Potential Species Occurrence scores are rough estimates of the effects of different alternatives and focus more on habitat quantity than quality. Factors not considered in this modeling process will also affect the value of a given habitat to wildlife. For example, the age a Refuge's habitats can affect their value to wildlife and will change as they continue to mature. would enhance these habitats for many wildlife species, but this is not reflected in the PSO scores.

4.3.3 Sedimentation and Water Quality

The Refuge would benefit from work with private landowners within the watershed to implement conservation practices that would reduce erosion and the resulting sedimentation. (Same as Alternative A.)

4.3.4 Public Use and Education

Under this alternative, we expect fewer visitors than in Alternative A. Because fewer Snow Geese would use the Refuge under this alternative, the Refuge would be less attractive as a destination for wildlife observation, especially to see large concentrations of birds. Environmental education and the other priority public uses would be the same as in Alternative A.

4.4 Alternative C: Enhance Public Use/Current Resource Management Level

4.4.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massasauga rattlesnake would benefit somewhat because the Refuge would maintain existing wet prairie (1,077 acres) habitat. Piping Plovers and Least Terns, both of which use sandbars and beaches for nesting, would benefit less under this alternative because it does nothing to alleviate sedimentation, which is filling in these habitats. Some species would benefit if the Refuge is successful in gaining regional shorebird designation as more attention is given to shorebird species. While studies monitoring the Blanding's turtle would continue, habitat would continue to degrade as marshes filled with silt. (Same as Alternative A.)

4.4.2 Wildlife and Habitat Resource Management

Direct resource effects same as Alternative A. If budget and staff are shifted to maximize public use, the shifts could negatively effect habitat management, fish and wildlife populations, and resource conservation as funding and staff are decreased for these programs.

4.4.3 Sedimentation and Water Quality

The Refuge would benefit from work with private landowners within the watershed to implement conservation practices that would reduce erosion and the resulting sedimentation. (Same as Alternative A.)

4.4.4 Public Use and Education

More visitors would be attracted to and accommodated on the Refuge (up to 175,000 annually). The visitor experience would change from a feeling of seeing few other people to a more social experience. There would be an increased positive economic effect on the community. Increases in environmental education would lead to long term changes in adoption of environmental stewardship. More visitors would experience the benefits of wildlife-dependent recreation.

4.5 Alternative D: Optimize Resource Management With Enhanced Public Use / Preferred Alternative

4.5.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massasauga rattlesnake would benefit slightly more than in Alternative A because the Refuge would increase bottomland mesic prairie by 217 acres. Some species would benefit if the Refuge is successful in gaining regional shorebird designation as more attention is given to shorebird species. Management is not likely to either benefit or harm the Indiana bat. Bat habitat and conservation measures would be unchanged.

4.5.2 Wildlife and Habitat Resource Management

This alternative shares many characteristics with Alternative A. Under this alternative, 279 acres of cropland would be converted to grasslands or prairie, potentially benefitting waterfowl and

grassland bird species. While waterfowl would lose cropland forage, converting it to natural vegetation would improve nesting habitat and provide more natural foods. This alternative, with its reduction of cropland and a spring Snow Goose hunt, would effect the redistribution and dispersion of the large flocks of Snow Geese. A managed spring Snow Goose hunt will contribute to the Snow Goose reduction efforts. Deer numbers would be decreased with the reduction of cropland acreage as an attractant. With an increase in mesic prairie in this alternative, there would be an increase in the carrying capacity for grassland dependent species.

4.5.3 Sedimentation and Water Quality

Under this alternative we would seek to quantify the need and benefit of various approaches, including land acquisition, to reducing sedimentation and improving water quality. In the long term this may lead to new management proposals that would benefit the ecological health of the Refuge.

4.5.4 Public Use and Education

Under Alternative D, public use and education efforts would see modest improvement. Completion of the visitor center will likely attract some additional users and open some new opportunities to convey refuge messages. Interactive programs and facilities would be developed with a goal of accommodating 130,000 visitors a year. Refuge staff would maintain environmental education programs at 2003 levels, and wildlife observation facilities and programs would be improved to encourage greater participation and more interaction with visitors. Opportunities to hunt white-tailed deer would be increased as part of the effort to reduce the Refuge deer herd. Opportunities to hunt Snow Geese would be created with a spring Snow Goose hunt on the Refuge. Public use efforts would seek to reach out to nontraditional Refuge users. Community awareness of the Refuge and Refuge goals would increase as greater focus is placed on involving volunteers and the Refuge's relationship with Friends of the Squaw Creek NWR.

4.6 Alternative E: Intensive Wetland Management with Extreme Measures to Combat Sedimentation

4.6.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massasauga rattlesnake would benefit somewhat because the Refuge would maintain existing wet prairie (1,077 acres) habitat. Piping Plovers and Least Terns, both of which use sandbars and beaches for nesting, would benefit less under this alternative because it does nothing to alleviate sedimentation, which is filling in these habitats. Some species would benefit if the Refuge is successful in gaining regional shorebird designation as more attention is given to shorebird species. While studies monitoring the Blanding's turtle would continue, habitat would continue to degrade as marshes filled with silt. (This alternative is the same as Alternative A.)

4.6.2 Wildlife and Habitat Resource Management

Alternative E would not drastically change wildlife and resource habitat management (See Table 3). Wetland, wet prairie, grassland and bottomland forest habitat acreages would change only slightly as the Refuge continued its current management trend toward less cropland. Current efforts to restore Loess Hill habitat would continue. All habitats would benefit from continued efforts to control invasive, exotic and nuisance species. All Refuge habitats would benefit from the Refuge working with private landowners on watershed improvements to reduce sedimentation caused by soil erosion.

Under this alternative, 279 acres of cropland would be converted to grasslands or prairie, potentially benefitting waterfowl and grassland bird species. While waterfowl would lose cropland forage, converting it to natural vegetation would improve nesting habitat and provide more natural foods. This alternative, with its reduction of cropland, would effect the redistribution and dispersion of the large flocks of Snow Geese. Deer numbers would be decreased with the reduction of cropland acreage as an attractant. With an increase in mesic prairie in this alternative, there would be an increase in the carrying capacity for grassland dependent species.

4.6.3 Sedimentation and Water Quality

Under this alternative we would seek to quantify the need and benefit of various approaches, including land acquisition, to reducing sedimentation and improving water quality. In the long term this may lead to new management proposals that would benefit the ecological health of the Refuge. (Same as Alternative D).

4.6.4 Public Use and Education

Under Alternative E, public use and education efforts would see modest improvement. Completion of the visitor center will likely attract some additional users and open some new opportunities to convey refuge messages. Interactive programs and facilities would be developed with a goal of accommodating 130,000 visitors a year. Refuge staff would maintain environmental education programs at 2003 levels, and wildlife observation facilities and programs would be improved to encourage greater participation and more interaction with visitors. Opportunities to hunt white-tailed deer would be increased as part of the effort to reduce the Refuge deer herd. Public use efforts would not seek to reach out to nontraditional Refuge users. Community awareness of the Refuge and Refuge goals might increase as greater focus is placed on involving volunteers and the Refuge's relationship with Friends of the Squaw Creek NWR. (Same as Alternative A).

4.7 Cumulative Impacts

“Cumulative impact” is the term that refers to impacts on the environment that result from the incremental impact of the proposed action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In this section, the cumulative impacts of each of the three alternatives are discussed in terms of waterfowl, migratory birds, listed species, wetland and riparian habitat, and prairie restoration.

4.7.1 Listed Species and Other Species of Special Interest

- Habitat loss and other factors across the range of certain wildlife species have caused declines in their populations to levels of special concern and classification. The Eastern Massasauga rattlesnake, Least Bittern, and Bald Eagle have special classifications and occur on the Refuge.
- Massasaugas are historically known from 13 sites in eight counties in Missouri. Eight populations (comprising four counties) are extirpated and two others are likely extirpated. Of the remaining three populations one is secure and two are vulnerable. Threats to the Massasauga still exist. Those threats will cause its numbers and range to continue declining and, as a result of those threats, it may become extinct in the future. Habitat loss is one of the primary factors in the decline of the eastern Massasauga.
- Least Bitterns are widespread, abundant, and secure globally, but are quite rare in parts of their range. They are classified as imperiled in Missouri because of rarity or because of factors making it very vulnerable to extirpation from the state. Least Bitterns were

described as locally common in large permanent marshes in most parts of the state in the early 1900s. Squaw Creek, Swan Lake, Mingo and the Mark Twain National Wildlife Refuges and the Ted Shanks and Marais Temps Clair state conservation areas now harbor the largest known breeding populations in the state.

- Bald Eagles were once very common throughout most of the United States. Their population numbers have been estimated at 300,000 to 500,000 birds in the early 1700s. Their population fell to “threatened” levels in the continental United States of less than 10,000 nesting pairs by the 1950s, and to “endangered” levels of less than 500 pairs by the early 1960s. The Bald Eagle is making a gradual dramatic recovery. There are now over 6,000 nesting eagle pairs and more than 20,000 individual birds in the lower 48 states. (American Eagle Foundation) The U.S. Fish & Wildlife Service is studying the removal of the Bald Eagle from the “threatened” species list.

4.7.1.1 Impacts of Alternatives

Alternatives A and C

Alternatives A and C would benefit the Eastern Massasauga rattlesnake by maintaining existing habitat (2003) and monitoring to assess habitat management impacts on snake populations. Alternatives A and C provide existing levels (2003) of habitat for the Least Bittern, an imperiled species in the State of Missouri. Both alternatives would benefit Bald Eagles by maintaining existing levels (2003) of bottomland cottonwood forest areas and isolated mature cottonwood stands

Alternatives B, D and E

Alternatives B, D and E increase wet prairie habitat by about 75 acres, providing a somewhat greater benefit to the species. Alternatives B, D and E provide slightly varied increases in acreages of Least Bittern habitat, resulting in somewhat greater long-term benefit for the species. Alternatives B and D would benefit Bald Eagles by maintaining existing levels (2003) of bottomland cottonwood forest areas and isolated mature cottonwood stands. However, in the long-term, Alternative E provides greater benefit to Bald Eagles by increasing acreages of habitat to support more wintering Bald Eagles.

4.7.2 Wildlife and Habitat Resource Management

- Prairies once occurred in every part of Missouri, including extensive prairies in the Ozarks and Bootheel.
- Of the remaining 90,000 acres of native prairie in Missouri, about 68,000 acres are in private ownership.
- An estimated 22,000 acres of native prairie are owned by the Missouri Department of Conservation the Department of Natural Resources, The Nature Conservancy, the Missouri Prairie Foundation, the University of Missouri and the Ozark Regional Land Trust. These agencies and organizations maintain prairie through selective cutting of woody species, periodic haying, grazing and prescribed burning.
- When Lewis and Clark embarked on their historic exploration of the west in 1803, the Missouri River was a diverse, 2,300-mile-long system of floodplain, braided channels, riparian lands, chutes, sloughs, islands, sandbars, and backwaters. The River constantly reshaped the channel and the floodplain, resulting in a complex natural system supporting an incredible diversity of fish, wildlife and plants.
- Six major dams were built in the upper reaches of the Missouri River in the first half of the 20th century. These dams and other river projects transformed the Missouri River from a free-flowing river into a series of reservoirs and channelized waterways, effectively separating the river from its floodplain. By 1972, the river's length had been shortened by 46 miles and its surface area decreased from 121,739 acres to 71,151 acres.

- Statewide, the loss of historic wetlands in Missouri has exceeded the national rate; approximately 87 percent of Missouri's original 4.5 million acres of wetlands have been lost.
- Roughly 168,000 acres of natural channel and 354,000 acres of associated habitat have been lost on the lower 730 miles of river.
- By 1972, floodplain forest that once made up 76 percent of floodplain vegetation comprised only 13 percent.
- Habitat loss and other factors have caused declines in species populations to the level of concern that warrants special classification.

4.7.2.1 Background

Historic losses of habitat and current struggles with sedimentation and water quality make habitat conservation a vital interest at Squaw Creek NWR. The Refuge is fortunate to have two other agencies, the U.S. Army Corps of Engineers and the Missouri Department of Conservation, also taking active roles in acquiring and restoring habitat in Holt County.

The Department of Conservation has identified adding limited critical areas to existing conservation areas as one of the agency's 10-year goals. In Holt County, the Department manages eight conservation areas, one of which is located adjacent to the Refuge.

In 2001, the Department of Conservation projected that willing landowners would restore 20,000 acres of wetlands in the northwest region, with the goal of targeting wetlands that are most valuable to wildlife. In addition, an estimated 3,300 acres of wetlands and bottomland hardwoods are scheduled for restoration on public lands, according to the Department of Conservation (<http://www.conservation.state.mo.us/areas/areaplans/nwest>).

The U.S. Army Corps of Engineers is also engaged in acquiring land in Holt County for habitat restoration purposes. The Missouri River Mitigation Project is designed to mitigate, or compensate, for fish and wildlife habitat losses that resulted from past channelization efforts on the Missouri River. The purpose of the project is to acquire, restore and preserve aquatic and terrestrial habitat on individual sites found along the project length. Under this project, existing natural areas would be improved and new areas created. Ultimately, the Project will develop approximately 166,750 acres of land in separate locations along the River in Missouri, Nebraska, Iowa and Kansas. In Holt County, four projects are under way: Corning (1,662 acres); Deroin Bend (1,082 acres); Rush Bottom Bend (811 acres) and Thurnau (1,349 acres).

4.7.2.2 Impacts of Alternatives

Under all five alternatives, watershed improvements would be achieved through conservation on private lands within the 60,000-acre watershed. The Refuge, in partnership with others, would work with land owners to reduce sedimentation from soil erosion and improve water quality through improved management practices.

Alternative A

Over time, wetland habitat could be expected to decline under Alternative A (No Action) and a corresponding decline in wildlife health and populations could be expected. Alternative A does not call for major changes in Refuge goals, objectives and strategies. Habitat would be conserved as it is today, which would not fully address long-term issues such as sedimentation in the wetland management units. There would be no further acquisition, thus expanded preservation and restoration of Missouri River floodplain habitat would not occur.

Under the No Action alternative, the U.S. Fish and Wildlife Service and Squaw Creek NWR would be failing to seize opportunities to contribute to the U.S. Army Corps of Engineers' achievements in the Missouri River Mitigation Project. In the same vein, the Refuge would not be capitalizing on the

ongoing acquisition of conservation areas by the Department of Conservation. Habitat acquired by these agencies would likely be more fragmented if the Service were not in a position to buy tracts adjoining other public lands.

This alternative does not contribute to reversing the dramatic loss of habitat, including prairies and wetlands, that the State of Missouri has experienced.

Alternative B

Restoring wet prairie habitat would be the focus of Alternative B (Historic Wet and Mesic Prairie), resulting in benefits for that particular habitat and somewhat diminished conditions for other habitats now fostered on the Refuge, such as floodplain forest and prairie. Discontinuation of burning, mowing and chemical spraying would diminish efforts to control invasive species. Species depending on wet prairie, such as the Eastern Massasauga rattlesnake, would benefit greatly while species that depend on other habitat types would see no benefit over current management. Wetland-dependent species would see a somewhat negative impact as the acres of managed wetland dropped from 3,409 to 1,227. In the short-term this alternative has a neutral impact on other waterfowl species; in the long-term, it does not enhance breeding and migration habitat needed to boost declining waterfowl populations.

Alternative C

Under Alternative C (Enhanced Public Use/Current Resource Management Level), land cover would remain essentially unchanged when compared to Alternative A (No Action). Because management focus and, with it funding, would be shifted to wildlife-dependent recreation, habitat and wildlife would likely experience negative impacts under this alternative. Habitat management, fish and wildlife monitoring, and resource conservation would have lesser priority than providing the six wildlife-dependent public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Staff availability for monitoring and inventorying projects would be decreased as visitor services programming increased. A spring Snow Goose hunt would be implemented to help control the continental population.

Habitat restoration by the Corps of Engineers as part of the Missouri River Mitigation Project would be less effective if the Service did not contribute to acquisition and restoration efforts. The effectiveness of conservation areas in reducing sedimentation and restoring habitat would be negatively impacted without similar efforts by the Refuge. Like Alternative A, this alternative does nothing to reverse trends in habitat loss in northwestern Missouri.

Alternative D

Of the five alternatives, the preferred alternative, Alternative D (Optimized Resource Management With Enhanced Public Use, Preferred Alternative), would generate the greatest benefits for wildlife and habitat by optimizing resource management and maintaining the current level of public use. A more concerted effort to conserve, manage and restore habitats that are native to the Lower Missouri River ecosystem would benefit wildlife species. A greater diversity of species would benefit from this alternative because it would include additional wetland, riparian, and native grass development and enhancement. Biological monitoring would increase, resulting in greater knowledge that could be used to better manage habitat. Greater monitoring of listed species would help staff manage more effectively for these species.

Under this alternative, the Refuge would aggressively study the needs and benefits of improving water quality coming onto the Refuge. The study may lead to a proposal for additional acquisition and restoration by governmental and non-governmental organizations. More land would be restored, potentially parcels located near one another, which would benefit all wildlife species using the Refuge. Restoring a larger land mass for habitat purposes would improve water quality by eliminating agricultural runoff over a greater area, and changing land use would contribute to

reducing soil erosion and, ultimately, sedimentation. This alternative would, in the long-term, contribute to replacing some of the vast amounts of habitat that have been lost in northwestern Missouri.

Alternative E

Under Alternative E (Emphasize Wetland Management for the Benefit of Migratory Waterfowl, Shorebirds, Wading Birds, and Other Aquatic Life), aquatic wildlife would see the greatest benefit over the long-term. The widest possible variety of wetland habitats (lacustrine, palustrine, moist soil, green tree, riverine, bottomland hardwoods, wet meadows, exposed flats) would be created and maintained. Species that would benefit would include ducks and geese, shorebirds and wading birds, and aquatic species such as otters. This alternative would benefit the Blanding's turtle, a state-listed endangered species.

4.7.3 Perilous Abundance of Snow Geese

- In 2001, 384,000 Snow Geese were counted on the Refuge in November.
- The Snow Goose population has been expanding at an average rate of about 5 percent per year.
- The major reason for this population growth has been improved winter survival and recruitment brought about by a virtually unlimited food supply due to the expansion and productivity of modern agriculture in the Midwest and the availability of sanctuaries and refuges.
- Over-grazing and grubbing of the tundra vegetation has been degrading and destroying the native plant community.
- In 1997, the Arctic Goose Habitat Working Group recommended that the mid-continent Snow Goose and Ross' Goose population be reduced by 50 percent, primarily through more liberal hunting regulations, unplugged shotguns, no limits, and electronic calls.
- In February, 1999, the Service implemented the above recommendations and published new regulations to authorize new methods of take (unplugged shotguns, electronic calls) during the regular season when other waterfowl and crane hunting seasons are closed. In addition, the Service created a conservation order, which allowed take of geese beyond March 10, removed bag limits, allowed new methods of take, and also allowed shooting hours to 1/2 hour after sunset.

4.7.3.1 Impacts of Alternatives

Under all five alternatives, Squaw Creek NWR would assist in international efforts to reduce the mid-continent population of Snow Geese. Snow Goose populations would be actively managed, resulting in greater mortality in the short-term but greater long-term benefits to the health of the species. Cropland would be reduced in alternatives B, D and E, which would make these alternatives more effective for Snow Goose Reduction in the long-term because they would provide less wintering habitat. With its spring Snow Goose hunt, Alternative D provides an additional means of dealing with the Snow Goose issue.

4.7.4 Sedimentation and Water Quality

- Squaw Creek NWR is filling in due to siltation.
- Within the Lower Missouri River Ecosystem, nearly 95 percent of the basin's land mass is applied to agriculture. Nonpoint source pollution is a major contributor to the contamination in the river and its floodplain.
- Erosion of farmland soils as well as direct rainfall runoff can introduce fertilizers and a variety of pesticides into the bottomland ecosystem.

- The presence of heavy metals such as mercury, selenium, copper and cadmium in sediments and fauna of the Missouri River and its tributaries have been documented over the years.
- Most of the 15,000 miles of streams in the Northwest Region of Missouri have suffered extensive channelization, unrestricted livestock access and sedimentation.

4.7.4.1 Impacts of Alternatives

All five alternatives would benefit the watershed and alleviate sedimentation by encouraging conservation practices and fostering improved soil and water uses. Under Alternative D, benefits would be somewhat greater because the Refuge would be actively studying additional means for improving water quality and reducing sedimentation.

The floodplain capacity to store flood water will increase under all alternatives. Increased flood storage capability means reduced flooding downstream and greater sediment retention and nutrient recycling. This in turn could reduce the sediment and nutrient load that eventually reaches the Gulf of Mexico. A reduction in nutrients reaching the Gulf could help moderate the hypoxia situation that results in depletion of oxygen and the subsequent death of many aquatic species in the broad area that is affected.

While the individual contribution to sediment retention and nutrient recycling is small under any alternative compared to the total sediment and nutrient load reaching the Gulf, the cumulative impact of the Refuge with other federal, state and non-governmental organizations together can be significant.

While significant efforts have been made by various states in the watershed and other agencies, including the Service, to restore wetlands and to restore habitats that reduce sediment runoff, much work still needs to be done. Over time, the Service's efforts working through the Squaw Creek Refuge and other national wildlife refuges and Waterfowl Production Areas, the Partners for Fish and Wildlife Program, and through partnerships with the State, the Corps of Engineers, and other agencies, the cumulative impact of the various programs can provide measurable positive results in improving water quality within the Missouri River floodplain.

4.7.5 Public Use

- Squaw Creek NWR receives an estimated 130,000 visitors annually.
- The U.S. Fish & Wildlife Service has identified six priority wildlife-dependent public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- Big Lake State Park, which is managed by the Missouri Department of Natural Resources, is a major feeding and resting area for birds and migratory waterfowl. The park offers lakeshore cabins and recreation.
- Several conservation areas owned by the Missouri Department of Conservation in Holt County, including the Bob Brown Conservation Area (3,302 acres), provide wildlife habitat as well as public use opportunities such as hunting, bird watching, camping and hiking.

Alternatives A, B, D and E

Under Alternative A (No Action), Alternative B, Alternative D and Alternative E, the Refuge would design and fund programs with the goal of supporting 130,000 visitors annually. The goal for environmental education would be to provide services to accommodate visitors at the same level as occurred in 2003. All Big Six programs would be developed or improved to meet Service standards. Under Alternative D, hunting on the Refuge would be expanded with the addition of a spring Snow

Goose hunt. In the short-term, these programs would meet existing needs in the area surrounding the Refuge. In the long-term, maintaining current levels under alternatives A, B and E would result in the Refuge failing to reach non-traditional visitors. However, like Alternative C, Alternative D would see efforts to reach out to non-traditional users. Refuge staff would work to enhance working relationships with volunteers and the Friends of Squaw Creek NWR and to increase the number of volunteer hours in the Visitor Contact Station and around the Refuge as interpretive guides. The focus on expanding volunteer hours would improve the Refuge's ability to engage visitors in environmental education programs and enhance visitors' experience on the Refuge. Under Alternative D and Alternative C, Refuge visitor facilities would be enhanced to improve the visitor experience.

Alternative C

Under Alternative C, wildlife-dependent recreation would be optimized. The Refuge would design and fund interpretive programs and facilities with the goal of accommodating 175,000 visitors annually by 2008, and increasing visitation by 2 percent annually after that year. The Refuge would become a more visible part of the community and a major element in environmental education and wildlife-dependent recreation in the area. The higher visitation numbers would result in greater appreciation for conservation, a better understanding of the National Wildlife Refuge System, and greater support for Squaw Creek NWR. A more informed local population would result in greater support for conservation in general and greater focus on local conservation issues. The proximity of Missouri Department of Conservation areas would enhance access to wildlife-dependent recreation in the area.

Table 4: Comparison of Impacts by Issue and Alternative

Issue	Alternative A Current Management (No Action)	Alternative B Historic Wet & Mesic Prairie	Alternative C Enhanced Public Use/ Current Resource Management Level	Alternative D Optimized Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
<i>Issue No. 1: Wildlife and habitat resource management.: Extraordinary measures may be required to preserve the marsh environment that has historically attracted migratory waterfowl and other wildlife.</i>	No change from current level of conservation. Carrying capacity remains unchanged by management.	Deer numbers will be decreased by removing the cropland as an attractant. Massassauga rattlesnakes would likely increase due to greater available habitat. Increase in carrying capacity of wet and mesic grasslands for dependent species, including associated threatened and endangered species. Significant decrease in carrying capacity for wetland-dependent species. Carrying capacity for woodland-dependent species unchanged.	No change from current level of conservation. Carrying capacity remains unchanged by management.	Greater reduction in Snow Geese numbers than Alternative A with reduced cropland and spring hunt. Deer numbers will be decreased by reducing the cropland acreage as an attractant. Massassauga rattlesnakes would likely increase due to greater available habitat. Increase in carrying capacity of wet and mesic grasslands for dependent species, including associated threatened and endangered species. Carrying capacity of woodland-dependent species decreased.	Greater reduction in Snow Goose numbers than Alternative A due to reduced cropland. Deer numbers will be decreased by reducing the cropland acreage as an attractant. Massassauga rattlesnakes would likely increase due to greater available habitat. Increase in carrying capacity of wet and mesic grasslands for dependent species, including associated threatened and endangered species. Slight decrease in carrying capacity for wetland-dependent species.
<i>Issue No. 2: Land management within the watershed impacts Refuge water quality: Beyond Refuge boundaries, land management practices within the watershed influence the quality and quantity of water that flows into the Refuge.</i>	No change.	No change.	No change.	Study of needs and benefits would lead to long-term improvement in water quality.	No change.

Table 4: Comparison of Impacts by Issue and Alternative (Continued)

Issue	Alternative A Current Management (No Action)	Alternative B Historic Wet & Mesic Prairie	Alternative C Enhanced Public Use/ Current Resource Management Level	Alternative D Optimized Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
<i>Issue No. 3: Snow Geese Management: The mid-continent population of Snow Geese is experiencing a "perilous abundance."</i>	Possible slight reduction in Snow Goose numbers.	Greater reduction in Snow Goose numbers over Alternative A due to elimination of cropland.	Possible slight reduction in Snow Geese.	Greater reduction in Snow Goose numbers over Alternative A due to reduced cropland and hunting program.	Greater reduction in Snow Geese numbers over Alternative A due to reduction in cropland.
<i>Issue No. 4: Refuge Expansion: Some Refuge marsh restoration and preservation problems associated with watershed management and runoff might be lessened if some adjacent agricultural land was added to the Refuge and converted to other uses.</i>	No change in boundaries. Complete acquisition of 400 acres of inholdings.	Same as Alternative A.	Same as Alternative A.	Study of possible benefits may lead to proposal for increased land acquisition.	Same as Alternative A.
<i>Issue No. 5: Public Use: Some people have suggested that the Refuge's public use program should be changed to allow other compatible uses, specifically waterfowl hunting and deer hunting.</i>	No change.	Some increased expressed dissatisfaction with lost opportunities to see large concentration of waterfowl.	Increase in public use opportunities.	Increase in public use opportunities, but to a lesser degree than in Alternative C.	Same as Alternative A.

Table 4: Comparison of Impacts by Issue and Alternative (Continued)

Issue	Alternative A Current Management (No Action)	Alternative B Historic Wet & Mesic Prairie	Alternative C Enhanced Public Use/ Current Resource Management Level	Alternative D Optimized Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
<i>Issue No. 6: Public Service: Refuge staff want to be good neighbors and contributors to the welfare of the community.</i>	No change.	No change.	Increase in Refuge visitors increasing use of local businesses. Increased environmental education opportunities and special events.	Greater increase in operating budgets and resulting input to the local economy than under Alternative b. Increased environmental education opportunities and special events but to a lesser degree than Alternative C.	No change.
<i>Listed Species</i>	Bald Eagle and Eastern Massasauga rattlesnake continue with current habitat.	Same as Alternative A.	Same as Alternative A.	Bald Eagle continues with current habitat. Eastern Massasauga rattlesnake benefits from increased habitat.	Same as Alternative D.
<i>Environmental Justice</i>	No disproportionate adverse effects on minority or low-income populations.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.

Chapter 5: List of Preparers

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Chapter 6: List Of Agencies, Organizations, And Persons Contacted

Elected Federal Officials

- U.S. Senator Christopher Bond
- U.S. Senator Jim Talent
- U.S. Representative Samuel Graves
- U.S. Representative Roy Blunt
- U.S. Representative JoAnn Emerson
- U.S. Representative Kenny Hulshof
- U.S. Representative Dick Gephardt
- U.S. Representative Todd Akin

Federal Agencies

- U.S. Army Corps of Engineers, Vicksburg Division, Rock Island and St. Louis Districts
- U.S. Geological Survey, Long Term Monitoring Program; Jackson, Missouri; Alton, Illinois
- U.S. Department of Agriculture/Natural Resources Conservation Service, Columbia, Missouri
- Environmental Protection Agency, Chicago, IL; Kansas City, Kansas
- Columbia Environmental Research Center, Columbia, Missouri
- Upper Midwest Science Center, LaCrosse, Wisconsin
- U.S. Coast Guard, Keokuk, Iowa
- Illinois River National Wildlife Refuge
- Shawnee National Forest, Murphysboro, Illinois
- U.S. Fish and Wildlife Service, Ecological Services, Rock Island, Illinois
- U.S. Fish and Wildlife Service Historic Preservation Officer

Elected State Officials

- Missouri Governor Bob Holden

State Agencies

- Missouri Department of Natural Resources
- Missouri Department of Conservation

- Missouri Department of Transportation
- University of Missouri, Extension Services
- State Historic Preservation Officer
- Office of the State Archeologist
- Indian Affairs Council
- Archaeological and historic preservation state-wide groups
- The Advisory Council on Historic Preservation

City/County/Local Governments

- Holt County
- Mound City

Public Libraries

- Mound City
- Oregon

Organizations

- Sierra Club, Kaskaskia Group Conservation Chair, Columbia, IL
- The Sierra Club, Washington, D.C.
- Ducks Unlimited
- Pheasants Forever
- Wild Turkey Federation
- The American Fisheries Society, Columbia, MO
- The Missouri Prairie Foundation, Columbia, MO
- The Wildlife Society, Missouri Chapter, MO Dept. of Conservation, Columbia, Missouri
- Missouri Wildlife Society, Hannibal, Missouri
- Missouri Conservation Foundation, Jefferson, Missouri
- Missouri Chapter American Fisheries Society, Missouri Department of Conservation, Jefferson City, Missouri
- The Conservation Federation of Missouri, Jefferson City, Missouri
- The Missouri Audubon Council, Jefferson City, Missouri
- The Missouri Bass Chapter Federation, Lake St. Louis, Missouri
- Missouri State Chapter, Soil and Water Conservation Society, Springfield, Missouri
- The Audubon Society of Missouri, St. Louis, Missouri
- Wildlife Management Institute, Washington, D.C.
- National Wildlife Foundation, Office of Federal and International Affairs, Washington, D.C.
- American Rivers, Washington, D.C.
- The Clean Water Fund, National Office, Washington, D.C.
- Defenders of Wildlife, Washington, D.C.
- The National Waterways Conference, Inc., Washington, D.C.
- The National Wildlife Refuge Association, Washington, D.C.

- The Natural Resources Council of America, Washington, D.C.
- National Audubon Society, Washington, D.C.
- Northeast Midwest Institute, Washington, D.C.

Individuals

- Individuals who participated in open house sessions or who requested to be on the Comprehensive Conservation Plan mailing list.

Chapter 7: Appendices

Appendix 1: References

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Appendix 2: Acronyms and Abbreviations Used in the Environmental Assessment

AgNPS - Agricultural Non-Point Source Pollution
CCP - Comprehensive Conservation Plan
COE - Corps of Engineers
CRP - Conservation Reserve Program
DNR - Department of Natural Resources
EA - Environmental Assessment
EWRP - Emergency Wetland Reserve Program
FONSI - Finding Of No Significant Impact
FmHA - Farmer(s Home Administration (now FSA)
FSA - Farm Service Agency
GIS - Geographic Information System
IADNR - Iowa Department of Natural Resources
MODOC - Missouri Department of Conservation
NEPA - National Environmental Policy Act
NRCS - Natural Resources Conservation Service
NWR - National Wildlife Refuge
PFW - Partners for Fish and Wildlife
RM - River Mile
ROS - Refuge Operations Specialist
USDA - United States Department of Agriculture
USEPA - United States Environmental Protection Agency
USFWS - United States Fish and Wildlife Service
USGS - United States Geological Survey
WRP - Wetland Reserve Program